An Argus Specialist Publication

# Computing today

OCTOBER 1983
80p

## The Sharp end of the wedge:

In-depth review of the new Japanese machines for home and business

Get more from your DOS – extra tracks for the TRS-80/Genie disc owner

Get a better text editor on your VIC 20

Decode the op-codes with our disassembler for Z80 micros

PLUS SOFTWARE REVIEWS: Go adventuring on the BBC and Spectrum

# BUILD YOUR OWN cortex 16 bit, 64 RAM colour computer

## Standard features –

- High speed 24K byte extended basic interpreter
- Powerful TMS9995 16 bit microcprocessor
- 48 bit floating point gives 11 digit accuracy
- High resolution (256 x 192) colour graphics
- Screen memory does not use up user memory space
- 16 colours available on the screen together in graphic mode
- Fast line drawing and point plotting basic commands
- High speed colour shape manipulation from basic
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- String and Array size limited only by memory size
- Real time clock included in basic
- Interval timing with 10mS resolution via TIC function
- Named load and save of basic or machine code programs
- Auto-run available for any program
- Powerful machine code monitor
- Assembler and Disassembler included as standard
- Auto line numbering facility
- Full renumber command
- Simple but powerful line editor
- Buffered i/o allows you to continue executing the program while still printing
- Flexible CALL statement allows linkage to machine code routines with up to 12 parameters
- Basic programs may contain spaces between key words to make programs readable without using more memory
- Over 34K bytes available for basic programs
- Extended basic includes IF-THEN-ELSE
- Supports up to 16 output devices: Screen and cassette interfaces included as standard
- Supports bit manipulation of variables from basic
- Error trapping to a basic routine included
- Basic supports Hexadecimal numbers
- Separate 16K video RAM for graphics

**With this powerful machine (featured in Electronics Today International as a constructional project) you have access to highly advanced systems and software developed specially by MPE Ltd for the CORTEX. For business, education, R & D – or simply increasing your knowledge and understanding of computers – it beats comparably priced off-the-shelf machines hands down!**

**STATEMENTS**
IF
ELSE
ON
GOTO
GOSUB
POP
REM
FOR
NEXT
ERROR
INPUT
PRINT
:
?
.
1 UNIT
BAUD
CALL
DATA
READ
RESTOR
RETURN
STOP
TIME
WAIT
SAVE
LOAD
MOTOR
ESCAPE
NOESC
RANDOM
ENTER
LIST
PURGE
NUMBER
RENUM
BOOT
GRAPH
TEXT
PLOT
UNPLOT
COLOUR
CHAR
SPRITE
SHAPE
SPUT
SGET
MAG
TOF
TON
DIM
LET
DEF
NEW
END
BIT
CRB
CRF
MEM
MWD
BASE

**COMMANDS**
RUN
SIZE
CONT
MON

**DELIMITERS**
TO
TAB
STEP
THEN
:
@
#
,
;
?
%
$
"
'
!
&
( )
[ ]

**FUNCTIONS**
FNA-FNZ
ABS
ADR
ASC
ATN
SIN
COS
EXP
FRA
INT
LOG
SQR
SYS
TIC
SGN
BIT
CPB
CRF
MEM
MWD
LEN
MCH
POS
COL
MOD
RND
KEY

**OPERATORS**
OR
LOR
AND
LAND
NOT
LNOT
LXOR
= =
=
>
>=
<
<=
<>
–
+
/
.
^

## Self assembly kit £295

**Ready built £395**

All prices exclusive of VAT. Carriage paid.

## Optional extras

| | |
|---|---|
| RS232C interface kit | £9.20 |
| Floppy disc interface | £65.50 |
| Pair of 5¼" disc drives | £300.00 |
| Hardware kit & connectors | £49.50 |

## Ready built

| | |
|---|---|
| CORTEX B – Basic machine + RS232C | £410.00 |
| CORTEX C – as above + disc drives | £895.00 |

*Full assembly instructions and 216 page user's manual.*

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**Computing Today is constantly on the look-out for well written articles and programs. If you think that your efforts meet our standards, please feel free to submit your work to us for consideration.**

**All material should be typed. Any programs submitted must be listed (cassette tapes and discs will not be accepted) and should be accompanied by sufficient documentation to enable their implementation. Please enclose an SAE if you want your manuscript returned, all submissions will be acknowledged. Any published work will be paid for.**

**All work for consideration should be sent to the Editor at our Charing Cross Road address.**

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**145 Charing Cross Road, London WC2H 0EE.**
**Telephone 01-437 1002-7. Telex 8811896.**

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AVAILABLE NOW

# DRAGON 32 OWNERS

AVAILABLE NOW

Now you can buy a professional disk system to turn your Dragon into a real computer!

## DELTA DISC SYSTEM

THE DELTA DISK SYSTEM gives you ....

* An affordable disk system
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DELTA contains the following powerful new words, all accessible directly from BASIC:-

| | | |
|---|---|---|
| SAVE" | SAVEM" | LOAD" |
| LOADM" | RUN" | RUNM" |
| CHAIN" | APPEND" | DIR |
| INIT | CONFIG | KILL |
| ASSIGN | VERIFY | SELECT |
| COPY | BACKUP | CREATE |
| FLUSH | OPEN | CLOSE |
| FILES | END# | RESTORE# |
| DIM# | BOOT | INPUT |
| PRINT | FIND | BUILD |
| DO | | IF EOF(x) THEN |

DELTA CARTRIDGE - contains DELTA Disk Operating System, User Manual, demonstration diskette. £99.95

DELTA 1 - DELTA Cartridge, User Manual, a single-sided 40 track (100K) drive plus free cable £299.95

DELTA 2 - as DELTA 1, but with a double-sided (200K) drive £345.95

Disk Interface cable (supplied free with DELTA 1 or 2) £9.95

ENCODER 09 assembler/disassembler/editor - integral with DELTA £34.95

INFORM - Data Base Management System commissioned especially for DELTA systems £39.95

SCRIBE - true lower case on DRAGON!

Below is a live 'screen dump', generated by our HIPRINT program. It clearly shows the features and display potential of SCRIBE!

SCRIBE for the DRAGON 32

* FULL UPPER and lower case direct from the keyboard
* An enlarged 42 x 24 screen display which gives a superb READABLE text
* Full text display on hi-res screen
* Automatic underline & reverse image
* Up to 255 user-defined graphics
* Precision character position command giving super/subscripts
* Black on white text display option
* A new PRINT@ command extending to 1008 thus almost doubling screen area

Cassette £13.95 DELTA disk £14.95

ENCODER 09 - is a full symbolic assembler using standard mnemonics and pseudo op-codes. Source code can be incorporated into BASIC programs. The monitor section contains commands to allow memory display, modification and execution. Memory block move, breakpoint handling, full disassembly and a full editor are only a few of its many features. The most powerful assembler/disassembler/editor available for the DRAGON 32. Available as either an integral DELTA fitment or on cassette.

Tape £29.95.Disk - see above

HIPRINT - screen dumper

- will dump the entire contents of your DRAGON 32 high-res screen to a high resolution printer. Can be used for design, display etc (see left). Available at present for EPSON printers only. Other modules to follow shortly.

Tape £13.95 DELTA disk £14.95

POSTAGE and PACKING
Software 95p. DELTA systems £4.50.
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# DISKPOST

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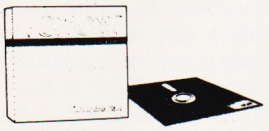

Manufactured by Verbatim, to accepted industry standards. Full one year warranty. Quality products at popular prices for both home and office use.

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| | | |
|---|---|---|
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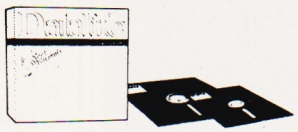
32 hard sector available at same price.

### DATALIFE DISKS



From Verbatim, the world's leading diskette manufacturer. Full 5 year warranty. All minidisks are certified for double density recording, and are fitted with hub ring reinforcement as standard.

**5.25'' DISKETTES**

| | | |
|---|---|---|
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48 TPI suitable for 35 or 40 track operation. 96 TPI suitable for 77 or 80 track operation. 10 and 16 hard sectored versions available at same prices.

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| | | |
|---|---|---|
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| **5012–2000** | S/S, D/D, 96 TPI | **£2.92** |
| **5022–2000** | D/S, D/D, 96 TPI | **£3.77** |

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**8'' DISKETTES**

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|---|---|---|
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Got a computing problem? Produce your own solution by using The Last One, a program generator which has helped to solve hundreds of problems in installations throughout the world.

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**Try out TLO for £50.**

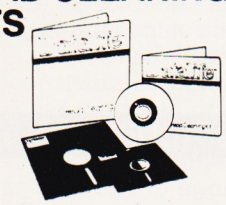
A limited demonstration version of TLO is now available for only £50, including full documentation. This cost is fully refundable against your subsequent purchase of a full version.

Full version costs:—

**for Apple II — £185**
**all other versions — £330**

Please specify version requirements when ordering.

### DISK DRIVE HEAD CLEANING KITS



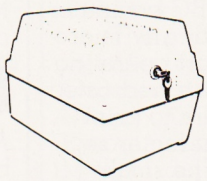
Helps to protect your valuable data, and minimise expensive downtime and repair costs. Consists of a flexible jacket, which receives a pre-saturated cleaning disk. Each disk is sealed within a foil sachet to ensure that it contains the right quantity of cleaning fluid when used. After use the disk is disposed of, and the jacket is kept for future use.

Suitable for single or dual head drives. Please specify 8'' or 5.25'' disks.

**STARTER KIT** **£8.12**
(contains jacket and two cleaning disks)

**REPLACEMENT CLEANING DISKS** **£15.54**
(pack of 10)

### DISKETTE STORAGE BOXES



Protect your diskettes and valuable data from external contamination. Lockable, portable and secure. Two part box made from anti-static ABS plastic. Price includes dividers and index labels. Capacity 80 disks.

**A5 Storage box** (for 8 disks) **£33.60**
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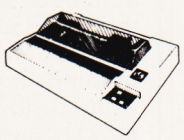
### CTI – CP80 PRINTER



**Features:—**

Friction and tractor feed as standard
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Bi-directional logic seeking.
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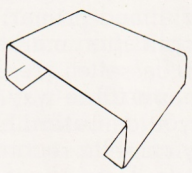
Print sample available on request.

**CP 80 PRINTER** **£289.00**
**Optional RS-232 interface** **£40.00**
**Special VIC20/VIC 64 interface** **£46.00**

### PRINTER STAND



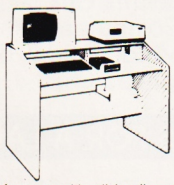
Suitable for use with dot matrix printers. Lifts printer sufficiently to enable continuous stationery to self-stack. Painted steel unit.
Dimensions: 39cm wide
x 28cm deep
x 10cm high

**Comes as package which also contains:—**

200 sheets continuous stationery.
1 x 9½'' binder.
1 x highlighter pen.
choice of rubber feet/sticky pads.

**PRINTER STAND** **£21.95**

### COMPUTER FURNITURE



Suitable for use with all leading personal computers. Features a top shelf for monitor/printer, lower shelf for books, paper and general storage; large desk top surface at keyboard height; attractive teak finish, and castors for mobility.

U.K. Manufacture. Comes in flat pack for self assembly – full instructions provided.

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| CT | **Sub Total** | £..... |
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# CONSUMER NEWS

## RECORDING . . .

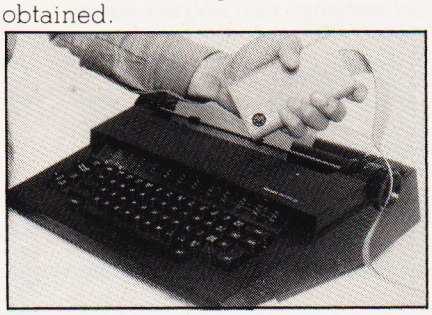
New from Sanyo is the DR101 data recorder aimed primarily at the home application market: standard C60/C90 cassettes are used. The DR101 has a three-way mode switch: you can use it as an ordinary cassette recorder or switch it to 'Data' input or output for use with a computer. The third mode also effects input/output with a computer but also offers audible data to be monitored through the recorder speaker. The DR101 is mains or battery operated and also includes a tape counter with reset. Priced at £39 excluding VAT, you can find out more from Sanyo Marubeni (UK) Limited, 8 Greycaine Road, Greycaine Estate, Watford, Hertfordshire WD2 4QU.

## HAMMERING IT HOME

The latest printer in the Seikosha range is the colour GP-700A. It incorporates a new technology into its operation: instead of making several passes each in a different colour, it has four hammers in its print head and can print any combination of colours in a single pass of the head. This makes it much faster; seven colours can be printed and up to 30 shades can be produced. If you would like more information, contact DRG Business Machines, Kingsway House, 103 Kingsway, London WC2B 6QW.

## JUST MY TYPE

For those with an Olivetti Praxis 30 or 35 daisy-wheel typewriter and a computer, but no way of connecting the two, Timtom Micro announce an enhanced version of their RS232C interface. Designed with the VIC-20 and BBC computer in mind, but suitable for any micro with an RS232C/423 port operating at 300 baud, it features a dedicated processor allowing users to print the complete Praxis character set from their computer. The small slim unit is easily fitted to the side of the Praxis, requires no external power supply, and does not interfere with normal operation as a typewriter. The all-inclusive price, which includes easy-to-follow fitting instructions is £69. Available direct from Timtom Micro, 9 Ilton Road, Penylan, Cardiff CF2 5DU, and where further details may also be obtained.



## CAMELS FOR STORAGE

MEMIC-81 allows the ZX81 to write and store BASIC or machine code programs over very long periods, typically five to 10 years, and is a useful aid to program generation and debugging. Novel applications are made possible by MEMIC-81's ability in loading programs almost instantly. An example is the quoting of prices in response to telephone enquiries. For example, suppose you are a label manufacturer who can make labels in 10 different base materials, in eight different shapes and in six different colour combinations. You ask about the area of each label and you charge a premium for rush orders. You program your pricing matrix into a MEMIC-81.2 which allows (long-term) storage. If a connection is joggled or there is a power failure, it doesn't bother you: when a customer phones, you enter his requirements into the matrix and quote him price and delivery on the spot. Must be good for business.

The listing of a simple pricing program as an example is supplied with each MEMIC-81. Comprehensive user notes give step-by-step instructions on saving and loading both BASIC and machine code programs. MEMIC-81's location in the ZX81's memory map and means of altering it are also given.

MEMIC-81 is priced at £29.95 plus VAT and you can find out more from Cambridge Microelectronics Limited, One Milton Road, Cambridge CB4 1UY or phone 0223-314814.

## FITTING ADDITION

A new range of add-on boards has been announced for the Sharp MZ-80A and MZ-80K micros. These boards replace the existing 2 MHz Z80 microprocessor with the faster Z80A CPU, thus effectively doubling the processing power of the micro. The board is easy to fit and only requires a minimum of practical skill. Anyone who is terrified of a screwdriver or soldering iron should get it fitted by a suitably qualified technician. The boards are exclusive to Kuma Computers and cost £69.50 plus VAT. More details can be obtained from Kuma Computers Limited, 11 York Road, Maidenhead, Berkshire SL6 1SQ or phone 0628-71778.

## BLOW THIS FOR A LARK

Available from Orme Electronics is an EPROM card, which will take 2516 and 2716 (2K) and 2532 (4K) EPROMs. Made for the 16K and 48K ZX Spectrums, the normal operation of even the latter (in which all the directly addressable memory is used) is not affected. There is 1K of unused ROM at locations 14592 to 15615 which the EPROM card uses. To use the full capacity of the EPROMs, memory paging is used: these memory

pages are software controlled using the OUT command. The tape recorder motor controller (when fitted) is also controlled with the OUT command. A 2.5 mm jack plug is plugged into the remote socket of the cassette recorder which enables the motor to be switched on and off.

The EPROM card is supplied with two forms of connector: a 28 by 28 way male connector and a 28 by 28 way female connector. A RAM adaptor is also available; this consists of a 2K 6116 static RAM and it plugs in directly to the EPROM card.

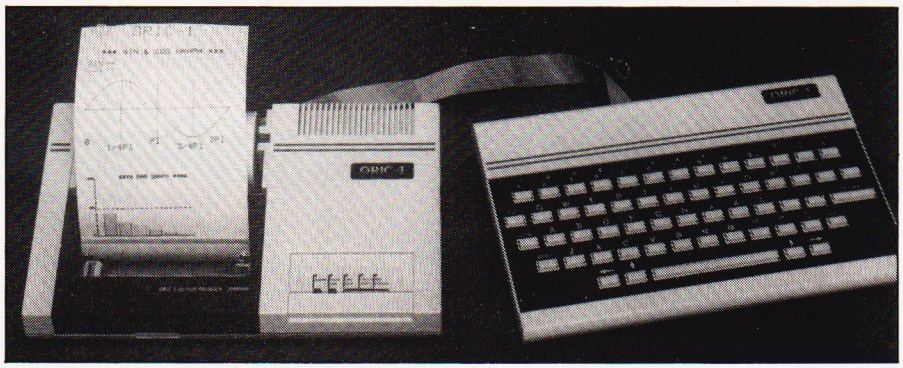
All software contained in the EPROM is top quality, user friendly and simple to use. Once the system has been OPENed, each of 10 routines is called, including Right Scroll, Left Scroll, Size, Spare Memory, Renumber and more. The EPROM-read card (with male connector suitable for motherboard) is £18.50; with a female connector that plugs into the computer it costs £21.25. The cassette recorder motor controller is £3.45 and the software (EPROM1) and the 6116 2K RAM adaptor are £9.95 each. An EPROM Programmer is also now available which works with the motherboard version of the EPROM-read card and costs £28.75 and a 25 volt stablised power supply for the programmer is £6.50.

More details can be obtained from Orme Electronics, 2 Barripper Road, Camborne, Cornwall TR14 7QN or phone 0209-715034.

## ORIC PRINTER

Oric Products' first peripheral for the Oric 1, the specially designed four-colour plain paper printer, is now available in retail outlets at £169.95 including VAT. The printer, which features the Alps mechanism and an internal power supply, comes complete with a connecting lead, and no other accessories are required. The Oric Colour Printer (MCP40) is plugged directly into the Oric expansion port and can be used with both 48K and 16K models.

The four colours, black, blue, red and green, are provided by rolling ball point pen dispensers. The printer features full alphanumeric capability and graphics specification. Sample programs are included in the manual. The Oric MCP40 has a standard Centronics interface and can therefore be used with any micro having a Centronics interface. For more details contact



Oric Products International Limited, Cowarth Park, London Road, Ascot, Berkshire SL5 7SE or phone 0990-27641.

## IN TIP-TOP SHAPE

A compact work desk, the Micro Tidy, to house all the equipment, tapes and manuals of the enthusiastic personal computer user is now available. The Micro Tidy (approximately 79 by 42 by 16.5 cm without legs) is finished in wood veneer and is designed to hold the micro with a tape recorder. It has a separate compartment with slots to take at least 16 cassette tapes and an adequate storage for manuals and notebooks.

The unit, which is lockable, is suitable for the VIC-20, Commodore 64, BBC Micro, Dragon 32, Sinclair machines, Epson and others. On its own, the Micro Tidy retails at £59.95: free-standing with black powder-coated metal legs, it costs £79.90 including VAT. Enquiries should be addressed to Abacus Marketing Limited, Abacus House, 60 Barbourne, Worcester WR1 1JA or phone 0905-611161.

## BRIEFING

At the end of July, the **Colour Genie** went up to 32K and down to £168 including VAT (the previous price was £194 for 16K). More details can be obtained from **Lowe Computers Limited**, Chesterfield Road, Bentley Bridge, Matlock, Derbyshire DE4 5LE.

Kuma Computers now hold the **Commodore 64** in stock with all the accessories such as disc drives and printers. Much of their existing range of application software will be going onto the Commodore 64, but they are actively seeking software authors who have programs for this machine, whether applications or entertainment software. Find out more by writing to **Kuma Computers Limited**, 11 York Road, Maidenhead, Berkshire SL6 1SQ.

Research Machines' servicing contractor, Kode Services Limited, are cutting the cost of maintenance on **RML 380Z** and **LINK 480Z** microcomputer packages by up to 37%. The reductions apply to both field maintenance and depot service carried out by Kode. For full details of the servicing prices or of the Research Machines products, contact **Research Machines Limited**, Mill Street, Oxford OX2 0BW or phone 0865-249866.

The 'Learning to Use' series of books are extremely popular and the latest in the group are: **Learning to Use the Dragon 32 Computer, Learning to Use the TI-99/4A Computer, Learning to Use the Apple II/IIe Computer** and **Learning to Use the Commodore 64 Computer**. The books cost £5.95 each including postage and packing. Newtech are also the distributors for the user-friendly **Sound Training** packs, audio training packs which include WordStar, Mailmerge, Wordcraft and CP/M. The packs retail at £40 including VAT and postage and packing. Contact **Newtech Publishing Limited**, 8 Forge Court, Reading Road, Yateley, Camberley, Surrey GU17 7RX.

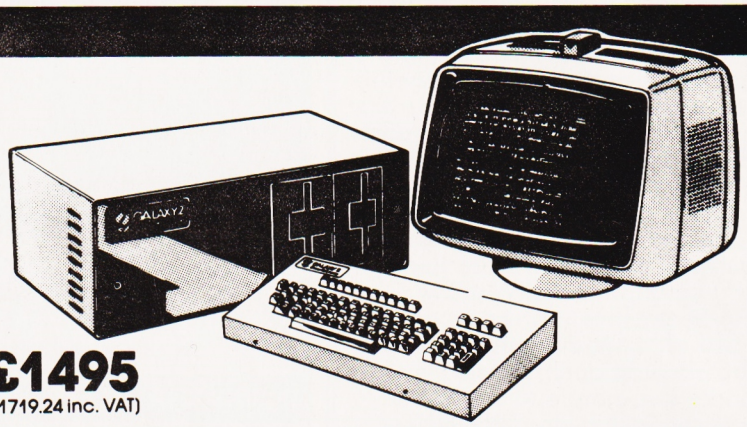
# Value - MicroValue - Micro

## COMPUTERS

### Gemini Galaxy 2

"I would place the Galaxy at the top of my list"
**(Computing Today, April 1983)**

- ★Twin Z80A Processors
- ★CP/M 2.2 Operating System
- ★64K Dynamic RAM
- ★800K Disk Capacity
- ★80x25 Video Display
- ★Serial and parallel printer interfaces
- ★Cassette and light pen interfaces
- ★User definable function keys
- ★Numeric key pad
- ★12" Monitor included



**£1495**
(£1719.24 inc. VAT)

## Total support for Gemini & nascom Products

### nascom 3 available from MicroValue

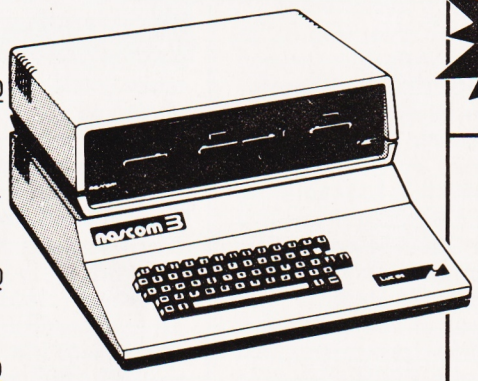
Based around the successful Nascom 2 computer, this new system can be built up into a complete disk based system. Supplied built and tested complete with PSU, Nas-Sys 3 and Nas-Gra.

**48K System**
**£549** (£631.35 inc. VAT)

**CP/M 2.2**
**£100** (£115 inc. VAT)

**NASCOM 2 KIT**
**£225** (£258.75 inc. VAT)

**Built & Tested**
**£285** (£327.75 inc. VAT)



### 80x25 Video for nascom

**£125**
(£143.75 inc. VAT)

Nascom owners can now have a professional 80x25 Video display by using the Gemini G812 Intelligent Video Card with on-board Z80A. This card does not occupy system memory space and provides over 50 user controllable functions including prog character set, fully compatible with Gemini G805 and G815/809 Disk Systems. Software supplied on Gemini system disks. Built and tested.

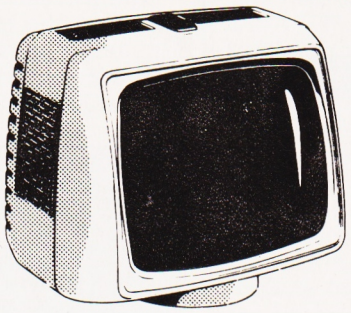
The **Microvector 256A** is a high performance graphics display interface on an 80-BUS and NASBUS compatible card. Various graphic primitives such as vector and character generation are executed in hardware by a Thompson EF9356 Graphic Display Processor. Plotting rates are typically 1 million pixels per second giving full animation capability. Various vector and character types can be selected. Characters can be scaled to give 256 different sizes.
MV 256A Suitable for TV use (PAL-UHF) **£199.00** + VAT
MV 256B Suitable for TV or RGB monitor **£220.00** + VAT

### SHARP MZ80A

**£475**
(£546.25 inc. VAT)

**Electronic magnificence from Sharp**

Z80A C.P.U. · 48K RAM · 4K ROM · Industry standard Qwerty keyboard with numeric pad · 9" GREEN C.R.T. · 1200 baud cassette · Music and sound · Real time clock · Enhanced BASIC · Full editing facilities · Internal expansion.



### Phoenix P12 Monitor

A high quality data display monitor, ideal for all Nascom and Gemini systems. 20MHz resolution. Available in amber or green phosphor.

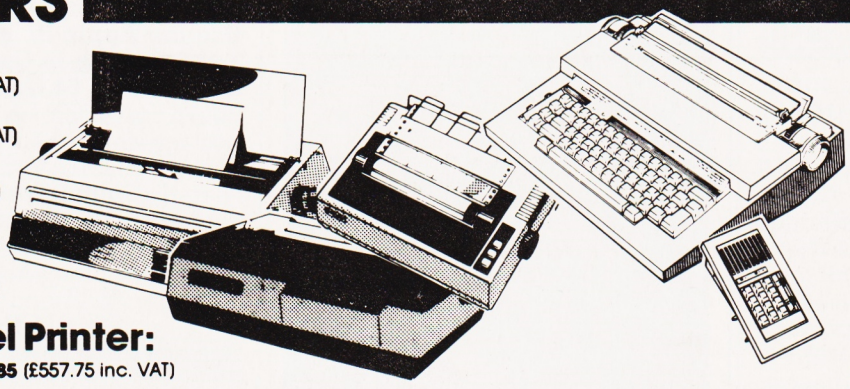
**£110**
(£126.50 inc. VAT)

## PRINTERS

Epson FX80
**£436** (£501.40 inc. VAT)
Epson RX80
**£298** (£342.70 inc. VAT)
Epson MX100 Type III
**£496** (£569.95 inc. VAT)
NEC 8023A
**£339** (£389.95 inc. VAT)
SEIKOSHA GP100A
**£215** (£246.95 inc. VAT)

### Daisy Wheel Printer:

Smith-Corona TP-1 **£485** (£557.75 inc. VAT)



### Olivetti Praxis 41

Complete with RS 232 interface and numeric key pad. This module enables the Praxis 41 to be used as:

- ★ a Personal Computer console
- ★ a quality, low volume printer
- ★ a typewriter communicating point-to-point, or via modem, or acoustic coupler.

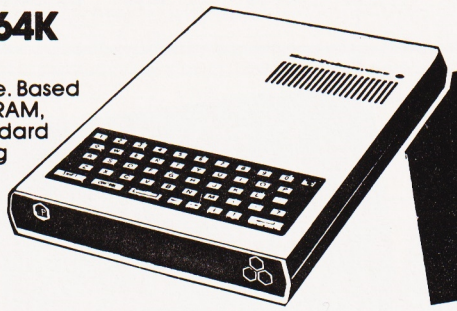
**£595** (£684.25 inc. VAT)

# Value - MicroValue - Micro

## LOW COST SYSTEMS

NEW **Micro Professor MPF II 64K**

MPF II is a most exciting addition to our range. Based on 6502 microprocessor this machine offers 64K of RAM, high resolution 6 colour graphics, and sound. Standard BASIC interpreter is Applesoft compatible, allowing MPF II to read and write tapes in Apple format. Complete with excellent 600 page manual.



BUY FROM THE COMPUTER PROFESSIONALS

| | | |
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| * Micro Professor | **£233.92** | (£268.99 inc V.A.T.) |
| * Joystick | **£13.00** | (£14.95 inc V.A.T.) |
| * MPF II printer | **£161.53** | (£185.75 inc V.A.T.) |
| * Software Cassettes | **£4.34** | (£4.99 inc V.A.T.) |

### Dragon 32

A powerful colour computer for under £180
* 32K RAM
* 6809E Microprocessor
* Extended Microsoft Colour BASIC
* 9 Colour, 5 Resolution Display
* Sound through TV 5 octaves, 255 tones
* Advanced Graphics

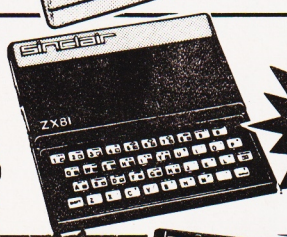
Full range of Dragon software available.

**£152.17** (£175 inc. VAT)

### Sinclair ZX81

Now available through MicroValue — a real computer for less than £50!

| | | |
|---|---|---|
| * Sinclair ZX81 Computer | **£43.43** | (£49.95 inc. VAT) |
| * Sinclair ZX Printer | **£34.74** | (£39.95 inc. VAT) |
| * ZX81 Learning Lab | **£17.35** | (£19.95 inc. VAT) |
| * Software for Sinclair | **from £3.43** | (£3.95 inc. VAT) |



SPECIAL OFFER 16K RAM PACK for ZX81 **£17.17** + VAT

### Sinclair ZX Spectrum

NEW LOW PRICES

Colour, sound and high resolution graphics from only £99.95

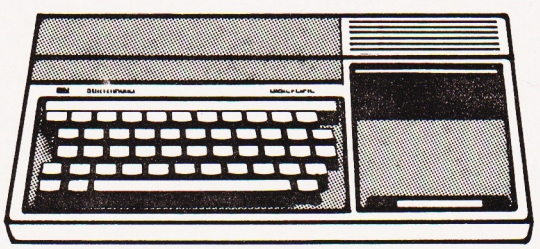
Expand your Spectrum to 48K with our new RAM PAK **£34.73** + VAT

* 16K ZX Spectrum Microcomputer **£86.92** (£99.95 incl. VAT)
* 48K ZX Spectrum Microcomputer **£113.00** (£129.95 incl. VAT)
* Sinclair ZX Printer **£34.74** (£39.95 inc. VAT)

### Texas TI99-4A

Colour, sound and a typewriter type keyboard for under £160

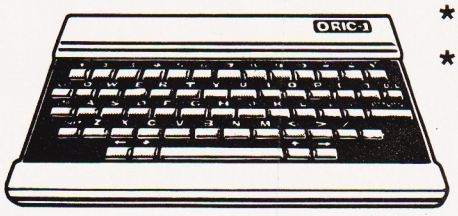
A truly expandable microcomputer system with a wide range of educational and games software.



* Texas TI99-4A Microcomputer 16K **£139.08** (£159.95 incl. VAT)
* Voice Synthesiser Unit **£43.43** (£49.95 incl. VAT)
* Peripheral Expansion Unit **£130.39** (£149.95 incl. VAT)
* Disk Drive **£278.21** (£319.95 incl. VAT)
* Disk Control board (for above) **£165.70** (£189.95 incl. VAT)

### ORIC 1

ORIC 1 when used with the ORIC MODEM will allow access to PRESTEL-Viewdata, which has 200,000 pages of interactive information covering sport, travel, hotel bookings, games, etc.



* ORIC 1 48K Microcomputer **£147.79** (£169.95 incl. VAT)
* ORIC 1 Communications Modem **£68.69** (£79.00 incl. VAT)

## MICROVALUE DEALERS:

**AMERSHAM, BUCKS**
Amersham Computer Centre,
18 Woodside Road,
Tel: (02403) 22307

**BRISTOL**
Target Electronics Ltd.,
16 Cherry Lane.
Tel: (0272) 421196

**EGHAM, SURREY**
Electrovalue Ltd.,
28 St. Judes Road,
Englefield Green.
Tel: (07843) 3603

**LEEDS**
Leeds Computer Centre,
60/62 Merrion Centre.
Tel: (0532) 458877

**IPSWICH**
MDW (Electronics),
47/49 Woodbridge Road East.
Tel: (0473) 78295

**LONDON W2**
Henry's Radio,
404 Edgware Road.
Tel: 01-402 6822

**LONDON SW11**
OFF Records,
Computer House,
58 Battersea Rise,
Clapham Junction.
Tel: 01-223 7730

**MANCHESTER M19**
EV Computing,
700 Burnage Lane.
Tel: 061-431 4866

**NOTTINGHAM**
Computerama,
(Skytronics Ltd.)
357 Derby Road.
Tel: (0602) 781742

**Telephone orders welcome**

Buy it with Access

# MicroValue

***REAL value — from the Professionals***

# SOFT WARES

## TODDLERS' GAMES

Longman Software have introduced three software titles for children in the 4-8 year age range. They are all educational in nature and designed for the ZX Spectrum. Countabout is an introduction to simple addition and subtraction, covering numbers from one to 10. Hot Dot Spotter is a game of speed and skill, teaching young children how to estimate numbers quickly. A,B,C . . . Lift-off! contains a computer based alphabet for young children plus a game encouraging letter and word recognition.

The retail price of each game is £7.95 including VAT and further details are available from Longman Software, Longman Group Limited, Longman House, Burnt Mill, Harlow, Essex CM20 2JE or phone 0279-26721.

## SOFT TOUCH

Kuma have produced some more useful packages. Cash Exchange is for comparison of foreign currencies and predicting trends. For the Epson HX-20, Cash Exchange enables the user to detect trends in currency rates, produce listings of currencies and calculate amounts to and from the chosen currencies using current or historical rates (going back tb January 1981). These can be displayed on the screen or printed graphically. Data for Sterling and Britain's main trading partners is included in the program with facilities and instructions for adding other currencies applicable for the user. Sixty four exchange rates including cross rates are available with the basic program with unlimited expansion using the microcassette. Cash Exchange is available for £19.50 plus VAT.

The Solidstate series of application programs have been around for the Commodore 64, the program has the following features: caters for a 12-month period, month by month; maximum of 50 entries per month; can have up to 10 expenditure and 10 income headings to a maximum combined total of 15; five payment codes as well as five income codes are available; entries can be entered into date order and can be searched for and if necessary changed; and monthly summaries may be printed out. Solidstate Accounts is priced at £24.50 including VAT.

Zen editor/assembler for the Newbrain consists of a cassette, manual and full assembly listing. It is not a tutorial on assembly language and a standard text book is recommended for this purpose. Full and detailed user instructions on operating Zen are in the manual. Some of Zen's features are full set of editor commands including string search; compact source files and free format text; file merging; decimal, hex and octal parameters; six maths operators; fully formatted List and Symbol Sort to screen or printer; paging for sheet feed printers; object to cassette or memory; and full object code debugger. Zen costs £29.95 plus VAT.

For information on any of the mentioned products contact Kuma Computers Limited, 11 York Road, Maidenhead, Berkshire SL6 1SQ.

## GREATER UNDERSTANDING

Understanding Ltd have announced several new products: a number of new versions of Corplan, the already popular management game which is widely used as a teaching and training aid from '0' and 'A' level of management level in schools and colleges are now available — for the ZX Spectrum, BBC Micro, NASCOM, and Apple as well as the Tandy TRS-80 Model III and Commodore PET 8032. Also available is a range of software specially designed for the small businessman and retail trader, including CP/M versions of the already popular Cashbook Model III and Trader packages. Two of the Company's new small business systems are now available for the BBC Micro as well as the TRS-80 Model III: VATkeeper and Invoicer.

All of these systems come complete with useful manuals and prices range from £49 to £99. For futher information contact Understanding Limited, 100 Crickelwood Lane, London NW2 2DS or phone 01-450 1144.

## AIMING FOR VIC-TORY

Five new cartridge games for the VIC-20 have been launched by Commodore. Gorf, a video arcade game, incorporates four completely different space adventures: Astro Battles, Laser Attack, Space Warp

and Flagship, and each one must be successfully completed before the operator can progress to the next challenging situation. Used with a Commodore joystick, Gorf is priced at £24.95 including VAT and plugs straight into the VIC-20.

Cosmic Jailbreak imagines an increase in space crime necessitating a high security prison to be established in the far reaches of the galaxy. The operator acts as the jailer and must defend against alien space ships, cosmic bugs, lasers, bombs and meteor showers. Played from the keyboard or with a joystick, Cosmic Jailbreak costs £19.95 including VAT.

Cosmic Cruncher is a starship and its mission is to destroy roving alien satellites. As the operator manoeuvres through various galaxies, refuge can only be taken in strategically placed space stations which supply the limited fire power. Cosmic Cruncher can be played with the keyboard or a joystick and costs £19.95 including VAT.

Menagerie deals with the plight of computer fleas on a treacherous journey to home base. After negotiating a river infested with ferocious flea-eating crocodiles and a deadly spider swamp, the fleas must complete their journey by hopping on the back of passing rabbits, dogs and elephants. Priced at £19.95, Menagerie can be played with either joystick or keyboard.

Take the money and run is the theme of the fifth game: Money Wars. With only a force field and a limited number of walls for protection, the operator has to escape with as much money as possible. Whilst shots sound and lights flash, arrows from above turn the character to a skeleton, then an angel, as it floats upwards to rest. Played from the keyboard, Money Wars costs £19.95.

## YE GODS!

From Zeus Software comes a utility for applications programmers using BASIC. Initially developed for users of Tandy Models I and III TRS-80s, Inped considerably reduces the time and effort for creating input, display and editing routines. The utility has been made with ease-of-use in mind and the programmer is presented with a multi-field input command with incorporated 'Printed @' options. The user can benefit from full cursor control and additional features include four functions related to Hex addressing, variable and labelled GOTO, variable GOSUB, date validation and compression, high speed graphic repeats and more.

The package is compatible with any disc operating system and can easily be appended to extended BASIC DOS. The utility is currently available for 48K level II machines only. The disc retails at £42.50 and £2.50 postage and packing. Dealer enquiries are welcome and DOS must be specified. Further information is available from Zeus Software, 37 Hamilton Square, Birkenhead, Merseyside L41 5BP.

## DON'T TAX YOUR BRAIN

A software package which could revolutionise life assurance and personal taxation counselling is now available. Claimed to be the first professional level software to be written for the Epson HX-20, the Computax package automatically carries out all the complex calculations involved in planning for legitimate tax avoidance. Within seconds the package carries out three important functions: using figures supplied by the client it computes actual or projected income tax liability, calculates the actual level of expenses needed to reach a required tax threshold, and shows the effect of various solutions.

In the event of a change to the taxation system, registered users of the system will be provided with an updated version of the program at a reduced cost. Priced at £49.50, Computax is distributed through Epson dealers. For more information contact P-Cam Systems Limited, Hanbury House, Welsh Street, Chepstow NP6 5LL.

## BEING TAUGHT A LESSON

Microdeal have introduced Tele-Tutor 1 for the Dragon 32. It consists of four programs: Spelling test, Word drill, Maths drill and Estimate.

Spelling test uses the sound track of the cassette recording to produce a standard oral spelling test, Word drill is designed to give a multiple choice vocabulary test; words and their definition are entered onto a data file which can be stored on tape. Maths drill may be used with up to six students at one time enabling practice of addition, subtraction, division and multiplication; it incorporates 10 levels of difficulty and a full report is made at the end of each test. Estimate is designed to help up to five students practice their mental arithmetic in the four main mathematical areas.

Instructions for the programs come in a detailed manual and the whole thing is packaged in a sealed A4 binder. It retails at £25 and is available through dealers or direct from Microdeal, 41 Truro Road, St Austell, Cornwall PL 25 5JE or phone 0726-67676.

## BRIEFING

Ratco Software has produced a machine code routine for the BBC Micro which allows character strings to be printed in one of four characters to be heightened, widened, rotated, reflected and/or inverted. The routine occupies 384 bytes, is relocatable and can be called from BASIC with the CALL statement. It is available (with a substantial domonstration program in BASIC) for £2 from **Ratco Software,** 3/177 College Road, Moseley, Birmingham B13 9IJ.

**Supercalc** is now available in a wide range of formats suitable for both eight and 16-bit micros. The even greater power of **Supercalc²** with a consolidation feature has helped to broaden the appeal of this spreadsheet system. Additional features are alpha/numeric sorts and a calendar/clock. The package comes complete with an improved easy to follow manual plus an introductory booklet which enables the novice to create a spreadsheet model in 10 minutes flat. The price of Supercalc² is £199 and the price of Supercalc has been reduced to £135. Details are available from **Softpac Limited,** 14 Castle Street, Bridgwater, Somerset TA6 3DB or phone 0278-421020.

Due to the volume demand for the **EDG Graphics Package,** Salamander Software have negotiated a reduction in price: the tape-based package is now £19.95 and the disc version is now £24.95. Tape-based package owners can upgrade to the disc package by returning their package to Salamander for replacement; the cost of the upgrade is £11.50 including carriage. More details can be obtained from **Salamander Software,** 17 Norfolk Road, Brigton, East Sussex BN1 4AA, phone 0273-771942.

# NEXT MONTH

# computing today

**NOVEMBER ISSUE ON SALE OCTOBER 14th**

## ADVENTURE

Next month's Computing Today will contain a free 16-page supplement concerned entirely with the subject dear to our reader's hearts — Adventure games. Like us, many of you like the challenge involved in cracking obscure clues (just what is it you have to do with that bent hatpin?), and trying to discover the individual quirks of the various authors in case that gives you an insight into a possible solution. Or maybe you like to set puzzles for other people to crack, or else the simple savagery of sword and sorcery provides a welcome diversion from your drab, tedious lives? We'll have something for everybody next month — tips on solving Adventure games, the sorts of things to bear in mind when you're totally stumped, plus some advice for those who would like to try writing their own Adventures. This will be required reading for anyone wishing to take part in the competition we have lined up for the December *Computing Today,* so start queuing outside your newsagent's now.

## THE LASER 200

From the land of the Rising Tower Block, Hong Kong, comes a small colour computer called the Laser 200. You may have seen one on show at the Computer Fair: now *Computing Today* has taken delivery of one for our usual in-depth hardware review.

First impressions are of a competitor aimed at the ZX Spectrum, still the leading contender at an end of the market where open warfare is breaking out. Read *Computing Today* next month to find out how it measures up.

**GIVE THIS TO YOUR NEWSAGENT**

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## OUR FORTH ISSUE

Actually *Computing Today* has been around a bit longer than that, but what we're trying to say is that there are several articles on the up-and-coming language of FORTH in the November issue. A new programming series aimed at the complete novice in FORTH will show how to speak this new tongue, whie a trio of commercial FORTHs for the Spectrum and Oric 1 will be reviewed. Finally there's a dictionary for the Jupiter Ace which will provide extended floating point capabilities such as LOG and EXP functions. Get CT and go bilingual.

## ZX LPRINT

Have you noticed how nasty Sinclair's silver printing paper goes if you handle it too much with sweaty fingers? Not to mention the problems we have in trying to reproduce listings of Spectrum programs in the magazine when printed using the ZX Printer. A possible solution has arisen in the form of the ZX LPRINT, an adaptor that allows the Spectrum to use better quality printers. Our reviewer has been trying out the hardware, writing some software and there'll be some examples of the possibilities to look at too.

## BBC MICRO WORD PROCESSOR

If you own a BBC Model B and an Epson MX-80F/T III printer, you have some suitable hardware to get into word processing. The November edition of *Computing Today* will provide you with some suitable software. Written in BASIC and machine code, the program provides several word processing functions such as entering and editing text, formatting the text to the VDU or printer, saving and loading text files, and performing search and replace. We can't make you a better writer, but we can make life between rejection slips a lot easier.

**Articles described here are in an advanced state of preparation but circumstances may dictate changes to the final contents.**

# There's one game you should play with a home computer before you buy it.

If you're looking for your first home computer, may we make a suggestion.

Tear out this page.

And ask these questions of every computer you look at.

1) Is the basic price reasonable, say under £180?

2) Does it work with a monitor as well as with an ordinary UHF T.V.?

3) Does it include a basic training manual that doesn't require a science degree to understand?

4) Does it have colour?

5) And sound?

6) Does it take cassettes?

7) And cartridges?

8) And can you operate them with joysticks working directly off the basic unit?

9) Does it have a professional quality keyboard that's guaranteed for twenty million depressions (and no headaches)?

10) Does it have colour graphics that are capable of producing detailed pictures?

11) Is the case robust enough to stand up to the kids?

12) Does it use a standard language that's not a million miles away from English?

13) Is there an expanding range of high quality software available from the makers?

14) Does the software include educational programs for adults as well as the very young?

15) And is there software sophisticated enough to satisfy the experts?

16) Does it use the most up to date technology, for instance the 6809E microprocessor?

17) Will it drive a standard printer directly from the basic unit?

18) Is it made in the UK?

19) And for the basic price will I get an easily accessible, yet large memory of at least 32K?

20) Or will I have to add lots of extras (and lots of money) for that much?

## 20 Questions.

After you've finished pestering every computer salesman in sight, compare your answers to these, courtesy of the Dragon 32 (this is, after all, an ad for the Dragon).

Questions 1-19. Yes, yes, yes, yes, yes, yes, yes, yes, yes, yes, yes, yes, yes, yes, yes, yes, yes, yes and yes. Question 20. No.

If you're thinking that that's a lot of computer for the money, you'd be right.

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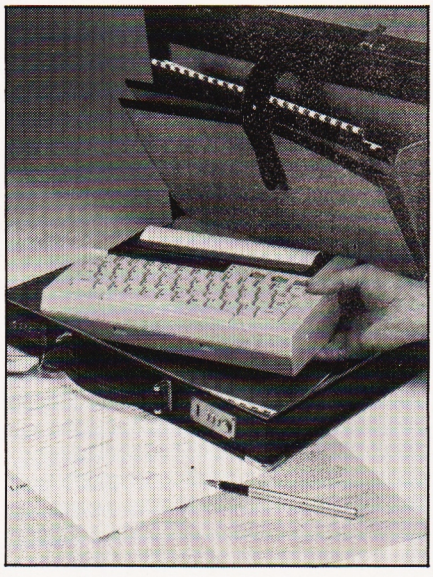
# BUSINESS NEWS

## SMALL TALK?

A lightweight, battery-powered data terminal which fits into half a standard-sized briefcase has been introduced by that prolific company, Texas Instruments. At 6lb weight without batteries, the Model 709 has a full-sized typewriter-like keyboard and print formats of both 80 or 132 columns per line from the totally new, virtually silent 9 by 1 element user-replaceable printhead.

An innovative ease-of-use feature is the provision for optional Solid-State Software cartridges which can provide special computer-like features and functionality. The first of these cartridges will allow the user to automatically dial up a computer and provide the user's log-on sequence. The Solid-State Software cartridge is also a route for terminal customisation to fit specific dedicated tasks.

The one-off price for the 709 in a typical configuration is about £800. More information can be obtained from Texas Instruments Limited, Manton Lane, Bedford MK41 7PA or phone 0234-67466.



## MAKING ADVANCES

NEC has announced its Advanced Personal Computer in the UK: this 16-bit personal computer has the ability to support up to 640K of main memory and offers a choice of operating systems including the CP/M-86 system. It is based on an

NEC-manufactured 16-bit 8086 compatible microprocessor.

The APC has a high graphics resolution of 1024 by 1024 pixels, with a movable window of 640 by 475 pixels which can be displayed at any one time, and the ability to display eight colours. There is also enhanced data storage with 8'' disc drives giving 2,000,000 characters of storage and a choice of operating systems (CP/M-86, MSDOS and the p-system). Software for the APC, to be distributed direct by NEC, includes packages for word processing, business accounting, financial modelling, data management, graphics and communications.

The APC model H01 (monochrome monitor, single disc drive, 128K and keyboard) costs £1875, model H02 (as H01 but with two disc drives) costs £1985 and model H03 (as H02 but a colour system) costs £3188. For more details contact NEC Business Systems (Europe) Limited, NEC House, 164/166 Drummond Street, London NW1 3HP or phone 01-388 6100.

## SEND A TELEX

A new high speed Telex service, based on the Epson HX20, is being offered by British Monomarks. The system can be used anywhere in the world and it links with the Monomarks Telex computer by ordinary telephone lines, sending messages down the wire several times faster than conventional Telex speed, cutting telephone costs and reducing the Monomarks service charges by up to 57%.

All the subscriber has to do is to type out his message on the micro's full-sized keyboard, check it and correct it on the integral LCD screen and then dial up the bureau, link his computer to the telephone receiver and send his message straight into the Monomarks computer which will automatically Telex it to the addressee. Similarly, the Epson HX20 can access messages that are stored in the Monomarks computer under the subscriber's own code. The Epson HX20 is battery-operated and incorporates a printer to produce permanent copies of incoming and outgoing messages.

The software has been developed by Wilder and Co and a complete support service will be offered by them. For more details contact Wilder and Co Computer Services, 123 Goldsworth Road, Woking, Surrey or phone 0276-21552.

## TITANIC IBM

Titan is a new multifunction board for the IBM PC. Its hardware includes two serial ports, a parallel port for a printer (which can also be used as a general purpose bidirectional parallel port), a hard disc interface, a real-time calendar/clock with battery back-up and 64K to 576K of parity checked dynamic RAM.

Support software includes Pseudo-disk, which makes the RAM on the board work like a very fast floppy disc drive providing extra on-line storage, and Pseudo-print, which lets the computer calculate while the printer is running and works with Pseudo-disk using only as much memory as it needs. The clock support program, Whatime, keeps track of the date and time so that the user does not have to type these in at each system restart. Initially the hard disc support software, Hardisk, is for the Creative Micro Systems 10M hard disc with the XEBEC controller.

The cost of Titan is £449 and you can get more details from Pete & Pam Computers, New Hall Hey Road, Rossendale, Lancashire BB4 6JG or phone 0706-227011.

## CATERING FOR EXECUTIVES

Osborne have announced their new Executive business computer.

Built-in features include an integral 7'' amber display screen, two half-height disc drives providing 200K storage per disc and IBM synchronous protocols and terminal emulation for easy interfacing with mainframe computers. Not only a powerful portable personal computer, the Osborne Executive also becomes a portable terminal enabling the user to plug in to a company's data base. Included with every Executive is a comprehensive array of software valued at over £1550, including the latest CP/M Plus operating system, Personal Pearl data base and the UCSD p-system in addition to Wordstar word processing, Supercalc electronic spreadsheets, CBASIC and MBASIC software. The most significant communications feature of the Executive is the Universal Terminal Emulator software package which enables the machine to be linked with almost any computer system. This is in addition to the optional COMM-PAC enhancement, available for the Osborne 1 and Executive, enabling national or international communications with autodialling over ordinary telephone lines.

The Osborne Executive sells for £1995 and you can find out more by contacting Osborne Computer Corporation (UK) Limited, 38 Tanners Drive, Blakelands, Milton Keynes MK14 5LL or phone 0908-615274.

## SMALL IS BEAUTIFUL ▶

Newbury Data's new Executive Terminal is a diminutive 5½'' visual display unit designed for both the executive's desk and as an on-the-counter enquiry terminal in banks, Post Offices and building societies. Priced at around £350 in quantities, the basic ET550 model comprises a 5½'' CRT on a 45 by 90 degree tilt and swivel head, a 7'' by 10'' base unit housing the Z80A microprocessor-controlled logic board, power supply and RS232C interface, and a movable numeric keypad.

The terminal incorporates a special non-glare screen and a very high refresh rate (100 cycles per second) to obviate the eye strain problems previously prevalent with small screen VDUs. The screen displays very sharp and stable characters, each cell occupying an 8 by 11 dot matrix, allowing a maximum of 12 lines by 40 columns.

More advanced versions are planned offering alphanumeric keyboards, programmable function keys, zoom, printer and Prestel interface ports. Special customised versions will also be available. For more information, contact Newbury Data Recording Limited, Hawthorne Road, Staines, Middlesex TW18 3JB or phone 0784-61500.

## CRA CORNER

As is widely known now, the Office of Fair Trading is launching an investigation of the trading practices of Acorn Computer. The UK microcomputer manufacturer says that it will fight to the end if the result goes against it.

This contretemps has arisen because Acorn will not permit their authorised dealers to on-sell to anybody but the end user. In other words, Acorn do not permit their dealers to sell to 'cowboy' dealers. The CRA is on record as supporting Acorn, or indeed any other manufacturer, in such a stand. We feel that the end user can only be properly supported by an authorised dealer and that if non-authorised dealers are able to buy microcomputers, their chief interest is to make some quick money rather than support the customer.

However, the CRA is also on record from some year or two ago, on another aspect of Acorn dealings with their dealers. It will be recalled that when the BBC machine was first launched, Acorn announced that there would be no room for any discount for dealers. After considerable pressure, including that from the CRA, Acorn decided to give a very small discount to dealers whom they authorised.

The CRA are very concerned with regard to the relationship between Acorn and their authorised dealers and consequently are circulating a questionnaire to BBC dealers to see whether or not they are satisfied or indeed can conduct a proper business under the present discount schedule. At the same time the questionnaire will contain appropriate enquiries as to any other matters relevant to the dealership.

If it transpires that BBC dealers are quite happy with the present arrangement, then of course that will be an end to the matter. If, on the other hand, it transpires that they are not, then the Executive Committee of the CRA have decided to take the matter further.

A.J. Harding, Public Relations Officer.

# SNOWBALL

**at £9.90 is the ultimate adventure for:**

***BBC*** 32K ***COMMODORE 64*** ***SPECTRUM*** 48K

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Snowball is a massive adventure with over 7000 locations. it took nine months to perfect and marks a new leap forward in adventure games - it has a detailed, planned background and is set aboard a huge starship that would really work. Snowball could be a glimpse of the future!

You play Kim Kimberley, security agent. Your mission is to guard the colony ship Snowball 9 from sabotage.

Thus when your freezer-coffin wakes you with the Snowball still in flight, you know that something must be very wrong. You're weakened and disorientated by lengthy hibernation, but the fate of the 5 mile long space-ship is in your hands!

---

Snowball is our new fourth adventure. Here's what the reviewers said about the first three:

"The descriptions are so good that few players could fail to be ensnared by the realism of the mythical worlds where they are the hero or heroine... The booklet supplied with each program is very helpful. Extensive information is supplied about the game scenario... The Level 9 programs are great fun to play, and plenty happens to keep you bemused and amused for hours on end"

*- Which Micro & Software Review, August*

"A minor miracle of programming" & "An impressive suite of adventures. They are always a pleasure to play"

*- Popular Computing Weekly, 12 May & 23 June*

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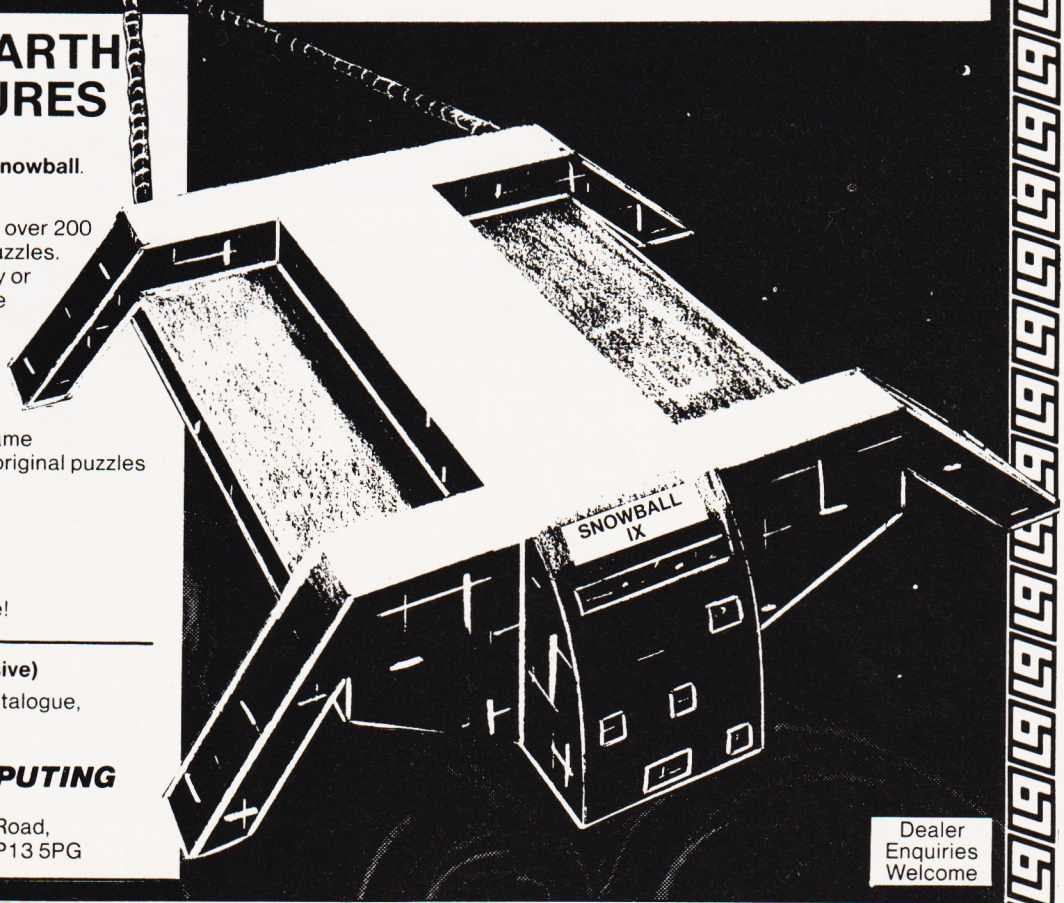


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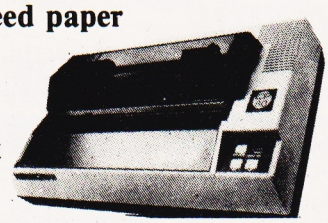

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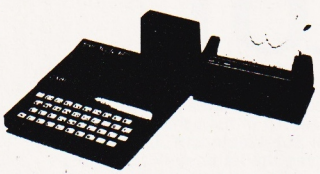


**ORIC AND SINCLAIR COMPUTERS**

Oric 1 computer 48K £143 (£114) £151. Oric 1 16K £104 (£107) £117. Oric colour printer £165 (£159) £169. Sinclair Spectrum 48K £131 (£133) £143. Spectrum 16K £101 (£107) £117. 32K memory upgrade kit for 16K Spectrum (issue 2 only) £31 (£28) £30. Fuller master unit for the Spectrum including speech synthesizer, amplifier and joystick ports £56 (£56) £62. Keyboards with proper spacebars for the ZX81 and Spectrum £43 (£41) £47. ZX printer with 5 free rolls paper £41. ZX printer alone £36 (£45) £50. 5 printer rolls £13 (£16) £21. ZX81 £48 (£52) £61. ZX81 16K ram packs £31 (£28) £30. New luxury spectrum computers 48K with full sizes typewriter keyboards complete with normal space bar enclosed in a larger plastic case which also houses the computer pcb £160 (£174) £190.

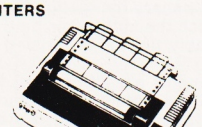
**COMMODORE COMPUTERS**

Commodore 64 £232.87 (£209) £229. Vic 20 with free cassette recorder, basic course and games £143 (£149) £179. Convertor to allow most ordinary mono cassette recorders to be used with the Vic 20 and Commodore 64 - built £9.78 (£9) £11, kit £7.40 (£7) £9. Commodore cassette recorder £43 (£44) £50. 1541 Disc drive £232.87 (£209) £234. 1525 Printer £235 (£220) £245. 1526 Printer £350 (£330) £360.

**OTHER COMPUTERS**

32K expanded Colour Genie £172 (£166) £196. BBC Model B £492 (£440) £480. Dragon 32 £212 (£202) £225.

**PRINTERS**



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Epson RX80 £326 (£309) £340. Shinwa CT CP80 £293 (£271) £312. Epson FX80 £440 (£408) £338. Epson MX100/3 £494 (£465) £495. Seikosha GP100A £234 (£219) £254. Oki Microline 80 £243 (£227) £268. The Silver Reed, the latest miracle, a combined daisy wheel and electric typewriter for only £448 (£425) £455. Juki 6100 proportional daisy wheel printer £423 (£404) £434. MCP40 colour printer £165 (£159) £169. Star STX80 thermal printer £165 (£159) £169. We can supply interfaces to run all the above from Sharp computers.

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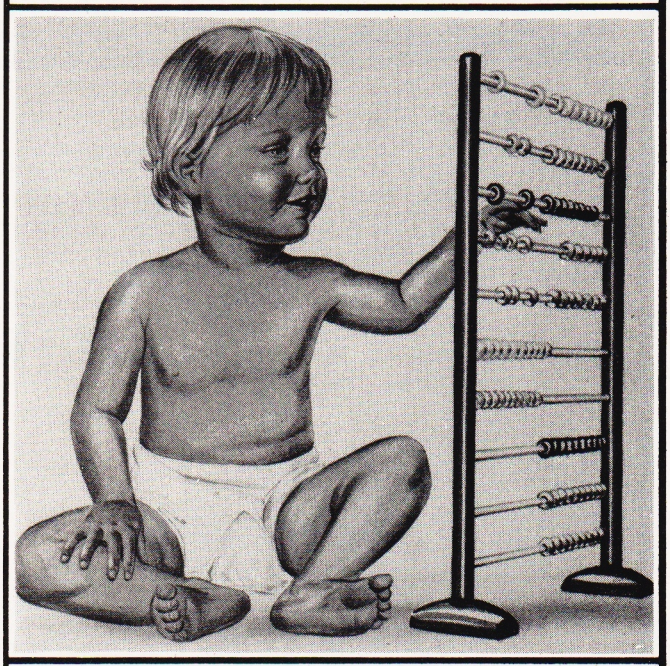

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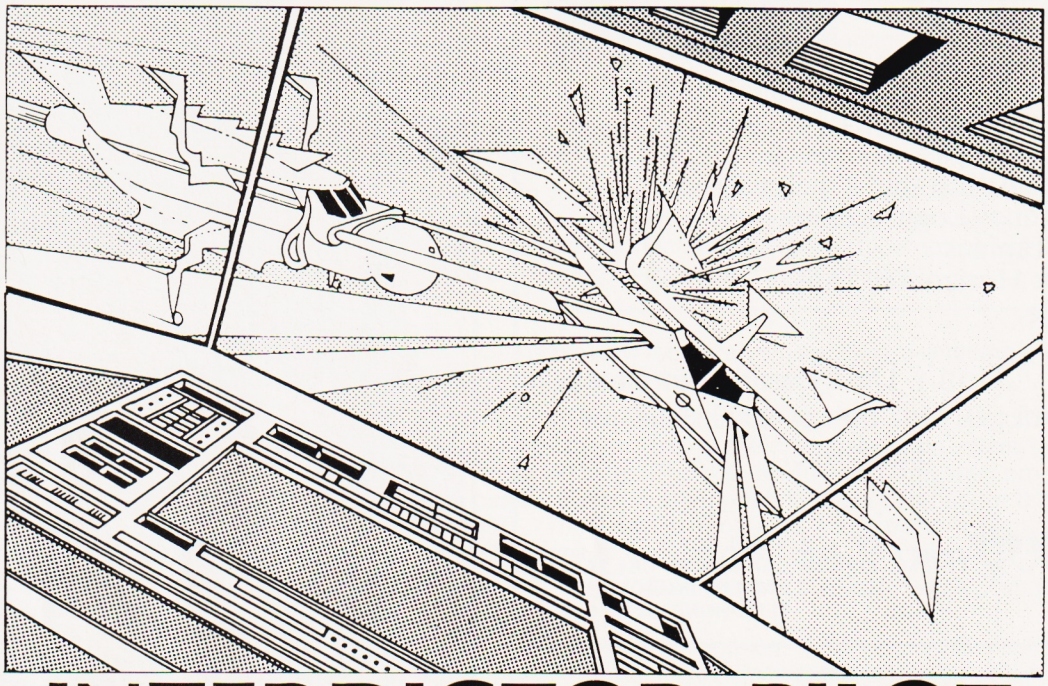
# Software News

## INNOVATIVE
## TRS 80-GENIE SOFTWARE
***from the professionals***



# INTERDICTOR PILOT

The background idea to Interdictor Pilot is not novel. The player is flying a space fighter called an Interdictor Mark II. After taking off from home starbase he has to transverse space at light speed until such time as he meets an opponent. When this occurs he is automatically taken out of light speed, does battle and if successful re-enters light speed until the next encounter. After a certain distance through space — depending upon his rank at the time — he will arrive at the first starbase, dock and report in, saving a record of his achievements or otherwise, to disk or tape. If all goes well and he is sufficiently skilled he will progress through the ranks of Sub-Lieutenant, Lieutenant, Lieutenant-Commander, Commander, Captain and finally Commodore. So far as is known, no one has achieved the latter rank, including the author. The higher the rank the greater the length of time during transits between starbases and the more frequent the contacts with the enemy.

The above is a not uncommon, even perhaps rather mundane, description of a space flying/fighting game. What makes Interdictor Pilot the fantastically interesting and fascinating pastime that it is, is the way in which the author has built on the basic theme. For instance, for a TRS-80, the graphics are little short of miraculous. Actually this is probably not too surprising because Interdictor Pilot is written in machine code and occupies a full 16K.

The pilot faces a viewing screen surrounded by instruments. These instruments are all graphic; thus for instance, when an enemy force appears the range indicator segment 8 is lit. As he comes closer, so succeeding segments are lit and the prior ones extinguished. Thus only a glance is required to see how close he is coming. Quite often in the dog fights that ensue, a glance is all that the Interdictor Pilot has.

Another example of the high quality graphics is when leaving or arriving at a starbase. A three dimensional tunnel appears, through which the pilot must navigate. When leaving he is nicely aligned, hence a few touches of the controls here and there will keep him on the straight and level out of the tunnel. When arriving at a starbase, however, the position is drastically changed. The opening of the tunnel is displayed and it is for the pilot to manoeuvre himself so that he not only flies into it, but also along it. Normally, the vision out through the screen is of space and this is really most amazingly realistic. The heavens seem to proceed across the screen almost exactly as one would imagine in real life.

Another amazing graphic realisation is that of an approaching enemy. He starts off as what appears to be a stationary star. As you increase speed to approach him, or he comes at you, so he gets larger until eventually you can make out the details of the craft and recognise it. If you are approaching him and do not collide, then he or you will swerve to one side and the effect as he passes over, under or to the side of you is extremely impressive. You almost want to duck.

One of the many alternatives open to you when you play the game is what is called the Simulation mode. This is strictly a practice mode. You have to take-off from a starbase in the normal way, but once in light speed you can choose the type of aircraft to fight, or you can also choose to practice docking with a starbase. Again, this simulation mode is not too astounding a feature in a game such as this, many have them. But what is so impressive is that the author has included a command whereby the enemy may be "paralysed". In this mode he is not allowed to move or fight. You can literally fly up to him, circle round, see him from any angle and then fly away again. We find this to be quite uncanny in its realism.

Interdictor Pilot is complex and completely fascinating. It is also extremely difficult. It comes with two manuals, the first is a short one showing you how to load the program and run it. The second is written in "real time" that is to say it is the manual which in the far distant future novice Interdictor Pilots will be handed when they first start to fly.

Interdictor Pilot is compatible with the Tandy Model I, III and 4 machines, together with the Genie I and Genie II.

Interdictor Pilot (Tape) ... **£14.95**
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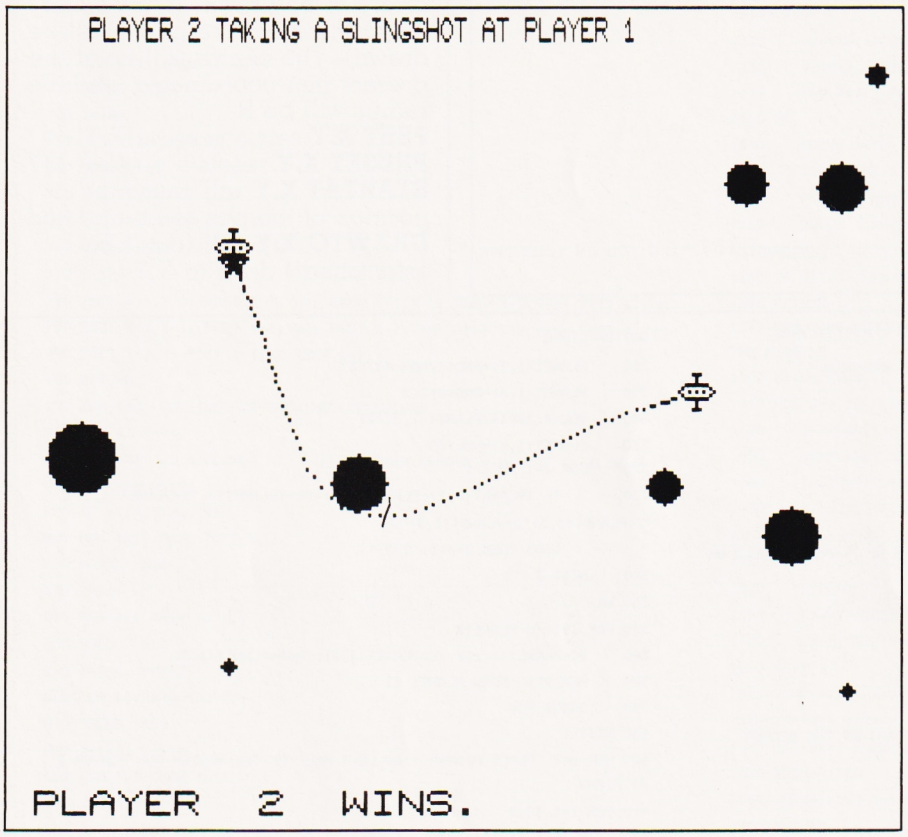
Karsten Plesner

# SLINGSHOT

**The space combat simulation is a must for celestial mechanics everywhere. Newton had trouble with the three-body problem — can you cope with 15?**




This program is actually an enhanced implementation of a game I first saw four years ago, at the University center of Roskilde (Denmark). That program was written in RC-COMAL, which might be considered to be the original version of COMAL-80. Though I removed some unwanted features, and added several new ones, I have tried to maintain the well-structured form of COMAL. The program was running on a Tektronix 4012 with very high-resolution graphics, and I decided to try to convert it to my Gemini 801, which has a resolution of up to 512 by 256 pixels. I chose to use a resolution of 256 by 256 pixels, as this would make the planets appear round. I assume you could use any resolution available, but the game will probably appear rather unreal if, for instance, you use elliptical planets, as a result of the vertical and horizontal resolution being too different. The program will use 4.5K if you remove all the REMs (there are no jumps to REM statements!). As listed, the program will occupy a little less than 6.5K.

| LINE | FUNCTION |
|---|---|
| 10-120 | Initialises the variable according to the number of planets chosen in line 50. Line 40 determines that only points whose coordinates for X and Y have values smaller than or equal to 255 will usable. |
| 130-190 | Ensures that the players take turns, and that the correct move is made if a missile hits something or is lost in space. |
| 200-250 | Used when a player either has hit himself, or the opponent. When the winner has been announced, the players will be given the opportunity of starting a new game. |
| 260-400 | Places the planets onto their correct position on the screen. The number 'PLANETS' is equal to the number of planets. |
| 410-540 | Affirms the exact positions of the spacecraft so that they aren't too close to each other, nor to the planets. |

## GAME PLAN

This is a game of 'interplanetary space combat'. It is a game for two players, who are each in charge of a spacecraft. The object of this game is to hit your opponent's spacecraft. The difference of this game from most others is that the missile you shoot at the opponent does not advance in a straight line. On the contrary, it is attracted to the planets in the area (see Fig. 1). The route of the missile is thus determined by a number of factors: the distance to the different planets, the sizes of these planets, and the velocity of the missile.

When you want to attempt to hit the opponent, you have to try to imagine how the missile will move when it is fired out in a certain angle. The angle has to be in degrees: 0° is towards the right, 90° is upwards, 180° is towards the left and 270° is downwards.

Each player is also responsible for the degree of attraction of the missiles towards the planets, as the attraction is proportional to the velocity of the missiles. At a low velocity the degree of attraction is greater than at a higher one. The velocity of a missile is determined by informing the computer of how long a time the missile is to keep on accelerating. The stated time has to be within the limit of 1 to 30 time units, inclusive. A planet's size will be reduced when it is hit by a missile. Hence, the diameter is shortened, and the attraction force is decreased.

At times, the missile will leave the screen. However, this does not necessarily mean that it is lost, as the combat area is greater in size than the screen.

## CONVERSION

The program is written in a standard 24K Microsoft BASIC and the recently released GRAPHPAC by CCSOFT. Converting the program for other machines should be quite straightforward providing that your machine has the basic plot primitives. As you may not recognise the graphic commands, these will be explained in order of appearance:

**GS** activates the graphics format screen and NS deactivates it. **LORES** selects low resolution

| | |
|---|---|
| 550-600 | Draws a circle having (XC,YC) as its coordinates, and RAD as its radius. |
| 630-800 | Draws a spacecraft at (X,Y). |
| 810-1010 | Draws an explosion, having its centre at (X,Y), if a spacecraft is hit, as well as removing the outer layer of the planet, when the latter is hit. |
| 1100-1390 | Ensures that the text is written on the two bottom lines and awaits the new orders for the next missile in terms of angle and time for acceleration. Furthermore, this subroutine is in charge of the movement of the missile during its acceleration. |
| 1400-1550 | Controls the movement of the missile after it has finished accelerating. |
| 1560-1600 | Checks out whether or not the missile has hit anything and if <ESC> has been pressed. If so, the variable 'HIT' will be adjusted accordingly. |
| 1620-1640 | Draws the new position of the missile if 0<X<XMAX and 0<Y<YMAX. The preceding position will not be erased if line 1630 is removed. The old position is represented by the variable (XOLD,YOLD). |
| 1650-1670 | Draws a line from the present pen-coordinates to (X,Y). |
| 1680-1690 | Moves from the present pen-coordinates to (X,Y) without drawing a line. |
| 1700-1710 | Clears the screen. |

## IMPORTANT VARIABLES

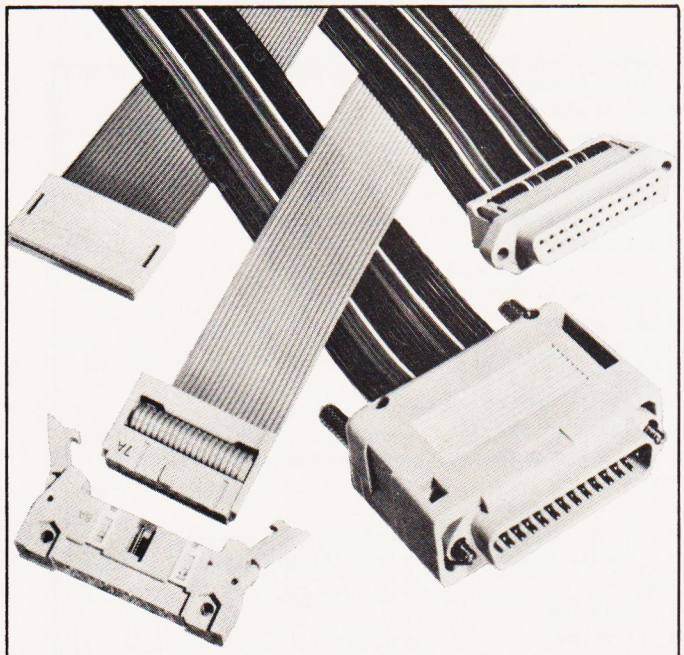
PLANET(I,1) is the X-coordinate of planet number I.
PLANET(I,2) is the Y-coordinate of planet number I.
PLANET(I,3) is the radius of planet number I.
PLANET(I,4) is the mass of planet number I.
SHIP(I,1) is the X-coordinate of spacecraft number I.
SHIP(I,2) is the Y-coordinate of spacecraft number I.
HIT = 1 if you just hit a planet, HIT = 2 if you hit your opponent, HIT = 3 if you hit your own ship and HIT = 4 if your missile is lost in space.

graphics (256*256).
**SCROLL n** causes the scrolling to affect only n lines of the video display.
**PENUP:** all subsequent graphic commands will only cause the position of the 'pen' to be updated, and no trace will appear.
**PENDOWN:** all following graphic commands will cause a trace to be displayed.
**PENERA:** all following graphic commands will cause any pixels already bright to be erased.
**CIRCLE R,A,B** Will cause a circle or arc to be drawn. (Only when A = 0 and B = 360 a circle will be drawn). The centre will be at the present pen-coordinates, and the radius will be R.
**PSET X,Y** sets a pixel at X,Y.
**PRESET X,Y** resets a pixel at X,Y.
**STARTAT X,Y** will cause the position of the pen to be updated.
**DRAWTO X,Y** will (don't be astonished!) draw to X,Y.

**Listing 1. Slingshot written using CCSOFT's GRAPHPAC.**

```
9 REM ### SETUP GRAPHIC SCREEN FOR LOW-RESOLUTION GRAPHICS
10 GS: LORES
20 RANDOMIZE
29 REM ### CLEAR SCREEN
30 GOSUB 1700
40 XMAX=255: YMAX=255
50 INPUT "HOW MANY PLANETS? ",PLANETS
60 IF PLANETS>15 OR PLANETS<1 THEN PRINT"THE NUMBER OF PLANETS SHOULD BE
1-15.": GOTO 50
70 PLANETS=INT(PLANETS)
80 DIM PLANET(PLANETS,4),SHIP(2,2)
90 PI=3.1416
99 REM ### CLEAR SCREEN
100 GOSUB 1700
109 REM ### PLACE PLANETS & SHIPS WITHIN VISIBLE PART OF THE SCREEN
110 GOSUB 260
120 PLAYER=INT(RND+1.5)
130 PLAYER=3-PLAYER
140 HIT=0
149 REM ### GET RESPONSE FROM PLAYER
150 GOSUB 1110
158 REM ### HIT=1 IF YOU HIT A PLANET, HIT=2 IF YOU HIT YOUR OPPONENT,
HIT=3
159 REM ### IF YOU HIT YOUR OWN SHIP AND HIT=4 IF YOUR MISSILE IS LOST
IN SPACE
160 IF HIT<>1 THEN 190
169 REM ### THE RADIUS OF THE PLANET WHICH IS HIT WILL BE REDUCED IF
POSSIBLE
170 IF PLANET(SHOT,3)>1 THEN PLANET(SHOT,3)=PLANET(SHOT,3)-1
180 IF PLANET(SHOT,3)<=1 THEN PLANET(SHOT,3)=.0001
190 IF HIT<>2 AND HIT<>3 THEN 130
199 REM ### GAME FINISHED. RESTORE NORMAL SCREEN
200 SCROLL 25
208 REM ### THE CHR$(14) IN LINE 210 WILL CAUSE DOUBLE-WIDTH LETTERS
TO BE
209 REM ### PRINTED. CHR$(15) WILL RESTORE NORMAL-SIZED LETTERS.
210 IF HIT=2 THEN PRINT CHR$(14)"PLAYER ";PLAYER;" WINS.";CHR$(15)
220 IF HIT=3 THEN PRINT "FOOL!! YOU JUST SHOT DOWN YOUR OWN SHIP!!!"
230 INPUT"DO YOU WANT TO PLAY AGAIN ? ",A$
240 IF LEFT$(A$,1)="Y" OR LEFT$(A$,1)="y" THEN CLEAR: GOTO 10
250 STOP
259 REM ### ROUTINE FOR SETTING UP THE SCENARIO
260 FOR I=1 TO PLANETS
270   PLANET(I,1)=RND*(XMAX-22)+11
279   REM ### MAKE SURE THAT THE PLANETS ARE PLACED ABOVE THE TWO
BOTTOM LINES
280   PLANET(I,2)=RND*(YMAX-48)+37
290   PLANET(I,3)=RND*8+2.5
300   VOL=4/3*PI*(PLANET(I,3)^2)
310   PLANET(I,4)=VOL/30
320   FOR J=1 TO I-1
330     IF (PLANET(J,1)-PLANET(I,1))^2+(PLANET(J,2)-PLANET(I,2))
^2<(PLANET(J,3)^2+PLANET(I,3)^2
        +100 THEN J=J+1: I=I-1
340   NEXT J
360 NEXT I
370 FOR I=1 TO PLANETS
380   XC=PLANET(I,1): YC=PLANET(I,2): RAD=PLANET(I,3)
389   REM ### DRAW PLANET #I
390   GOSUB 550
400 NEXT I
409 REM ### PLACE PLAYER 1 AT LEFT HALF OF THE SCREEN AND PLAYER 2
AT RIGHT
410 FOR I=1 TO 2
420   SHIP(1,1)=10+90*RND: SHIP(1,2)=30+(YMAX-40)*RND: SHIP(2,1)
=(XMAX-10)-90*RND:
SHIP(2,2)=30+(YMAX-40)*RND
430   TOOCLOSE=0
440   FOR J=1 TO PLANETS
450     IF ABS(SHIP(I,1)-PLANET(J,1))<6+PLANET(J,3) OR ABS(SHIP(I,2)
-PLANET(J,2))<6+
        PLANET(J,3) THEN TOOCLOSE=-1
460   NEXT J
469   REM ### IF TOOCLOSE<>FALSE THEN REPOSITION SHIPS
470   IF TOOCLOSE THEN GOTO 420
480 NEXT I
489 REM ### MAKE SURE THAT SHIPS ARE NOT TOO CLOSE
490 IF ((SHIP(1,1)-SHIP(2,1))^2+(SHIP(1,2)-SHIP(2,2))^2)<5500 THEN
GOTO 410
500 X=SHIP(1,1): Y=SHIP(1,2)
509 REM ### DRAW SHIP #1
510 GOSUB 630
520 X=SHIP(2,1): Y=SHIP(2,2)
529 REM ### DRAW SHIP #2
530 GOSUB 630
540 RETURN
549 REM ### THIS ROUTINE DRAWS A PLANET (CENTER AT (XC,YC) AND
RADIUS=RAD)
550 PENDOWN
560 STARTAT XC,YC
570 FOR J=1 TO RAD
```

```
580    CIRCLE J,0,360
590 NEXT J
600 RETURN
629 REM ***  THIS ROUTINE DRAWS THE SPACECRAFTS AT (X,Y)
630 X=X+4
639 REM ***  MOVE TO X,Y
640 GOSUB 1680
650 X=X-2: Y=Y+2
659 REM ***  DRAW TO X,Y
660 GOSUB 1650
670 X=X-6
679 REM ***  DRAW TO X,Y
680 GOSUB 1650
690 Y=Y-2: X=X-2
699 REM ***  DRAW TO X,Y
700 GOSUB 1650
710 Y=Y-2: X=X+2
719 REM ***  DRAW TO X,Y
720 GOSUB 1650
730 X=X+6
739 REM ***  DRAW TO X,Y
740 GOSUB 1650
750 X=X+2: Y=Y+2
759 REM ***  DRAW TO X,Y
760 GOSUB 1650
770 X=X-4
780 PSET X-1,Y-3: PSET X-1,Y-4: PSET X-1,Y-5: PSET X-2,Y-5: PSET X,Y-5
790 PSET X-1,Y+3: PSET X-1,Y+4: PSET X-1,Y+5: PSET X-2,Y+5: PSET X,Y+5
795 PSET X-3,Y: PSET X-1,Y: PSET X+1,Y
800 RETURN
809 REM ***  ROUTINE FOR SHOWING EXPLOSIONS
810 X=X-4: Y=Y+2
819 REM ***  IS A PLANET HIT? IF YES THEN REMOVE A BIT OF IT ELSE
DRAW AN EXPLOSION
820 IF HIT=1 THEN 970
829 REM ***  MOVE TO X,Y
830 GOSUB 1680
840 X=X+8
849 REM *** DRAW TO X,Y
850 GOSUB 1650
860 X=X-6: Y=Y-5
869 REM *** DRAW TO X,Y
870 GOSUB 1650
880 X=X+2: Y=Y+8
889 REM *** DRAW TO X,Y
890 GOSUB 1650
900 X=X+2: Y=Y-8
909 REM *** DRAW TO X,Y
910 GOSUB 1650
920 X=X-6: Y=Y+5
929 REM *** DRAW TO X,Y
930 GOSUB 1650
940 X=X+4: Y=Y-2
949 REM ***  MOVE TO X,Y
950 GOSUB 1680
960 RETURN
969 REM ***  REMOVE A BIT OF THE PLANET
970 X=PLANET(SHOT,1): Y=PLANET(SHOT,2)
980 RAD=PLANET(SHOT,3)
989 REM ***  MOVE TO X,Y
990 GOSUB 1680
1000 PENERA: CIRCLE RAD,0,360
1010 RETURN
1109 REM ***  MAKE SURE THAT ALL TEXT IS WRITTEN AT THE BOTTOM OF
THE SCREEN
1110 SCROLL 2
1120 FOR I=1 TO 25: PRINT [CD];: NEXT I
1130 PRINT PLAYER;"   ";
1140 INPUT "ANGLE ",ANGLE
1150 ANGLE=ANGLE/180*PI
1160 INPUT"TIME ",T
1170 IF T<1 OR T>30 THEN 1160 ELSE PRINT
1180 X=SHIP(PLAYER,1)+7*COS(ANGLE)
1190 Y=SHIP(PLAYER,2)+7*SIN(ANGLE)
1200 VX=.35*COS(ANGLE): VY=.35*SIN(ANGLE)
1209 REM *** MOVE TO X,Y
1210 GOSUB 1680
1220 TIME=0
1230 X=X+VX: Y=Y+VY
1240 VX=VX+.2*COS(ANGLE): VY=VY+.2*SIN(ANGLE)
1250 TIME=TIME+1
1259 REM ***  SHOW NEXT POSITION OF MISSILE
1260 GOSUB 1620
1270 XOLD=X: YOLD=Y
1280 IF TIME<T AND TIME<10 THEN GOTO 1230
1290 WHILE HIT=0
1299    REM ***  ACCELERATION FINISHED?
1300    IF TIME>=T THEN 1340
1310    IF VX=0 THEN ANGLE=PI-PI/2*SGN(VY) ELSE ANGLE=ATN(VY/VX)
-PI*(VX<0)
1320    VX=VX+.1*COS(ANGLE)
1330    VY=VY+.1*SIN(ANGLE)
1339    REM ***  CALCULATE THE NEW DIRECTION AND DISTANCE THE MISSILE
WILL GO.
1340    GOSUB 1400
1350    TIME=TIME+1
1359    REM *** ANYTHING HIT?
1360    GOSUB 1560
1370 WEND
1380 IF HIT<3 THEN GOSUB 810
1390 RETURN
1399 REM ***  ROUTINE FOR CALCULATING NEW DIRECTION AND DISTANCE FOR
THE MISSILE
1400 KX=0: KY=0
1410 FOR J=1 TO PLANETS
1420    IF PLANET(J,3)<=.001 THEN GOTO 1500
1430    DX=PLANET(J,1)-X: DY=PLANET(J,2)-Y
1440    DIST2=DX^2+DY^2
1450    IF DIST2<PLANET(J,3)^2 THEN SHOT=J: J=PLANETS: HIT=1: KX=0:
KY=0: VX=0: VY=0: GOTO 1500
1460    IF DX=0 THEN RET=PI-PI/2*SGN(DY) ELSE RET=ATN(DY/DX)-PI*(DX<0)
1470    G=PLANET(J,3)^2/DIST2
1480    KX=KX+G*COS(RET)
1490    KY=KY+G*SIN(RET)
1500 NEXT J
1510 VX=VX+KX: VY=VY+KY
1520 X=X+VX: Y=Y+VY
1529 REM ***  SHOW NEXT POSITION OF MISSILE IF VISIBLE
1530 GOSUB 1620
1540 XOLD=X: YOLD=Y
1550 RETURN
1559 REM *** ROUTINE FOR CHECKING WHETHER ANYTHING HAS BEEN HIT
1560 IF HIT=0 THEN HIT=-2*((X-SHIP(3-PLAYER,1))^2+(Y-SHIP(3-PLAYER,2))
^2<25)
1568 REM ***  IF ESCAPE IS PRESSED THEN THE MISSILE WILL BE CONSIDERED
LOST IN
1569 REM ***  SPACE AND THE OPPONENT MAY HAVE A TRY
1570 IF INP(0)=27 THEN HIT=4
1580 IF HIT=0 THEN HIT=-3*((X-SHIP(PLAYER,1))^2+(Y-SHIP(PLAYER,2))^2<9)
1590 IF HIT=0 THEN HIT=-4*(X<-20 OR 276<X OR Y<-20 OR 276<Y)
1600 RETURN
1618 REM ***  DRAW SHOT. IF YOU WANT TO SEE THE TRACE, AND NOT ONLY
THE PRESENT
1619 REM ***  POSITION OF THE MISSILE, REMOVE LINE 1630
1620 IF X>0 AND XMAX>X AND Y>0 AND YMAX>Y THEN PSET X,Y
1630 IF XOLD<>X OR YOLD<>Y THEN PRESET XOLD,YOLD
1640 RETURN
1649 REM *** ROUTINE FOR DRAWING FROM PRESENT PEN-COORDINATES TO X,Y
IF VISIBLE
1650 IF X<0 OR XMAX<X OR Y<0 OR YMAX<Y THEN PENUP
1660 IF X>0 AND XMAX>X AND Y>0 AND Y<YMAX THEN PENDOWN: DRAWTO X,Y
1670 RETURN
1679 REM ***  MOVE TO X,Y SUBROUTINE
1680 PENUP: DRAWTO X,Y
1690 RETURN
1699 REM ***  CLEAR SCREEN SUBROUTINE
1700 CLS
1710 RETURN
```



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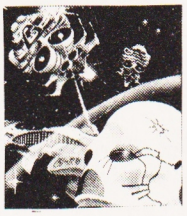

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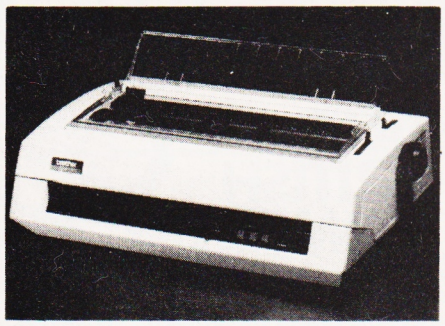

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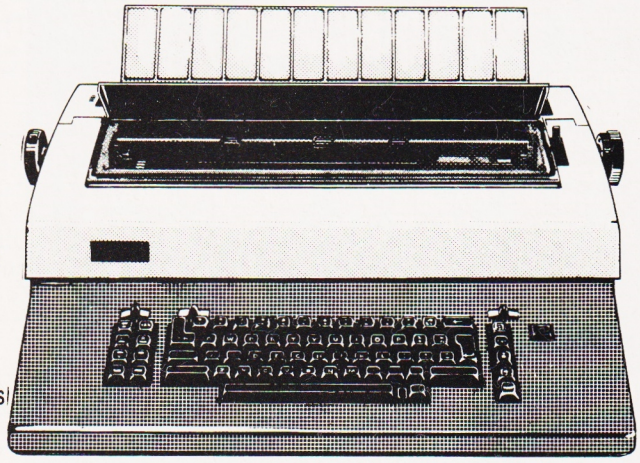

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# LANGUAGES IN USE

## When are block graphics not block graphics? When they're pseudo high-res. This month we explain the technique using BASIC and LISP programs.

The basic techniques for programming block graphics displays are quite well developed now. In some quarters the view has been expressed that block graphics have had their day and they have now been superseded by high-resolution graphics. However, a closer look at the microcomputer graphics scene reveals that this is not the case. The considered use of block graphics allows intricate displays to be created with the use of very little memory overhead. Indeed, the introduction of 'sprites' and 'M O Bs' (moveable object blocks) on more recent micros, together with the capability to handle them in sophisticated ways with quite simple graphics programming, has led to a renewal of interest in block graphics.

When using block graphics we can think of any image as being composed of a list of block graphics characters, each of which occupies a particular position so that the positions can be arranged in the same order as the characters in a list of their own. In this way any display can be represented by a pair of lists. The computer language LISP is intended specifically for manipulating lists. To illustrate the way that LISP works and to explore its suitability as an alternative language to BASIC, we shall examine ways in which block graphic displays can be created using LISP.

## ON DISPLAY

The principal technique for creating block graphics displays takes advantage of the fact that the screens of block graphics systems are memory mapped. This means that when the code for a block graphics character is placed in the memory location that corresponds to a particular screen position, the graphics character automatically appears in that position. The BASIC command that permits a number to be placed in a particular memory location is POKE, and this command is central in block graphics programming. The only machine on which displays cannot be created with its use is the Texas Instruments TI-99/4A, where the PRINT command must be used since it possesses no POKE command in its BASIC.

To create the image given in Fig. 1, where it is illustrated

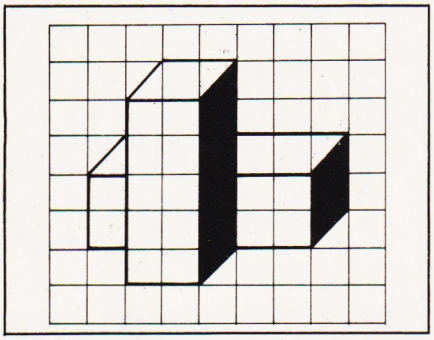

**Fig. 1. Image composed of block graphics characters.**

against a grid which shows the character positions, we therefore need to know the codes of the graphics characters involved and the addresses of the memory locations corresponding to the screen positions that are occupied by graphics characters. The codes and the screen memory map vary from machine to machine. Figures 2 and 3 give the information as it applies to the PET. Using this information, the program in Listing 1 produces the required display. Even a comparatively simple display such as this uses nine different graphics characters and places the characters in 29 screen positions.

There is no way to avoid using the codes for the graphics characters in a program of this kind. It is, however, possible to use screen positions instead of addresses in the region of memory that is mapped to the screen. This is much more convenient for the graphics programmer. It can be done by incorporating the screen memory mapping function in the program so that it can compute the address of the memory location corresponding to any screen position. A second program to generate the display of Fig. 1 which uses data consisting of the screen column and row that each character is shown in Listing 2.

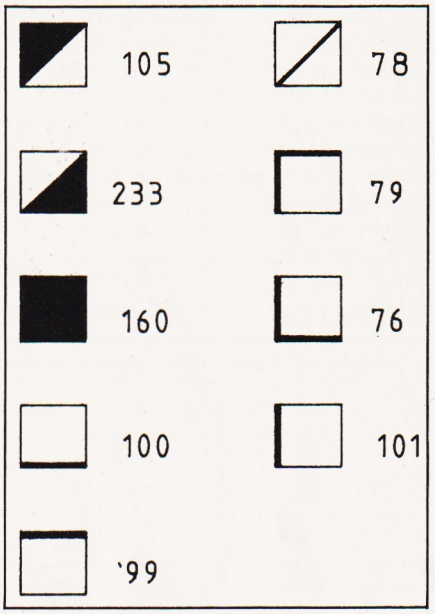


**Fig. 2. Block graphics characters in Fig. 1.**

## INTERACTION

It is often more enjoyable, and more useful, to be able to design and draw images on the screen interactively. Many programs to do this have been written and published, and the third program shows how simple and compact such a program can be. It is presented here in on of its shortest possible forms so that its essential principles can be observed and also because it provides the basis for another program to be developed later.

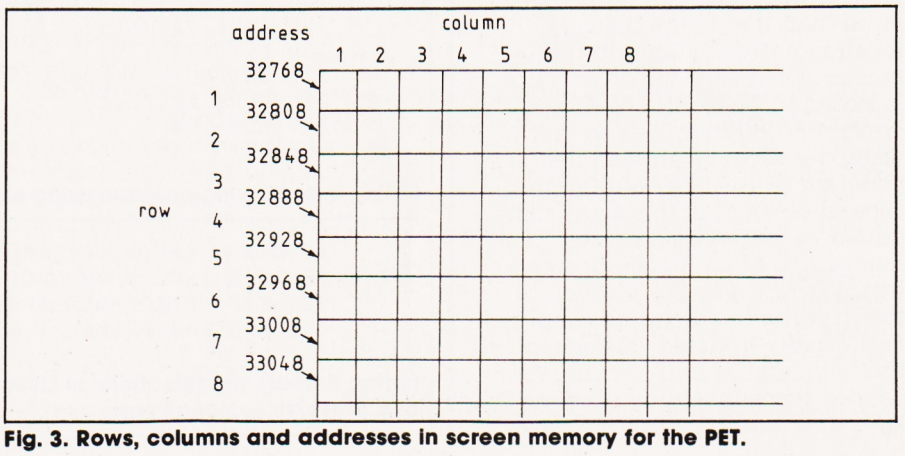


**Fig. 3. Rows, columns and addresses in screen memory for the PET.**

The idea of the program is that the number of keys on the numeric keypad can be used to drive a 'drawing head' round the screen, leaving a trace as it moves so that a drawing is created. This program causes a trace consisting of a full-sized character block (PET code 160) to be left so that the trace can appear fairly clumsy. However, it should be remembered that it is in the nature of block graphics that they provide low-resolution displays. A way of improving the resolution is examined in the next section. The present program only permits the drawing head to be moved up and down, and to the left and right. However, it is a simple matter to extend it to permit movement in diagonal directions to occur. The scheme for movement control makes use of the keys as shown in Fig. 4. The 5 key provides a static representation of the drawing head, and to drive the drawing head down the screen it is

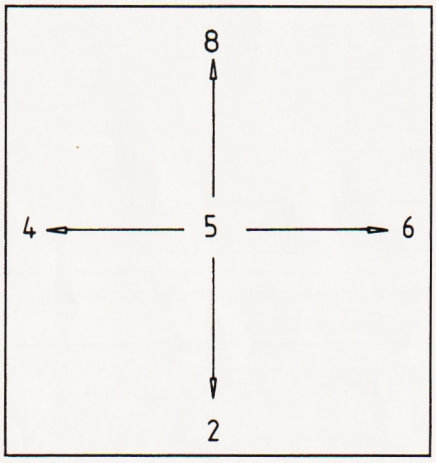


**Fig. 4. Movement control scheme.**

only necessary to press the key that is down from the 5 (the 2 key). The trace can be extended in the other permitted directions in a similar fashion.

Since (on the PET) the screen is mapped in rows of 40, the screen position that is down from the current position of the drawing head is always mapped to a memory location with address 40 more than that of the memory location corresponding to the current position. This offset value is stored in element 2 of an array containing offset values so that when the 2 key is pressed the program causes the value in the second element of this array to be added to the present address of the memory location for the drawing head. In this way the position of the drawing head can be simply and rapidly updated. Movements to the left, right and up, which are caused respectively by pressing keys 4, 6, and 8 can be similarly

```
10 PRINT "[CLS]"
20 FOR I=1 TO 29
30 READ AD,PC
40 POKE AD,PC
50 NEXT I
60 DATA 32771,100,32772,100,32810,78,32812,233
70 DATA 32850,79,32851,99,32852,160,32853,100
80 DATA 32854,100,32855,100,32889,78,32890,101
90 DATA 32892,160,32895,233,32929,79,32930,101
100 DATA 32932,160,32933,99,32934,99,32935,160
110 DATA 32969,76,32970,101,32972,160,32973,100
120 DATA 32974,100,32975,105,33010,76,33011,100
130 DATA 33012,105
```

**Listing 1. Simple program to produce block graphics on the PET.**

```
10 PRINT "[CLS]"
20 FOR I=1 TO 29
30 READ CO,RO,PC
40 AD=32768+40*(RO-1)+CO-1
50 POKE AD,PC
60 NEXT I
70 DATA 4,1,100,5,1,100,3,2,78,5,2,233
80 DATA 3,3,79,4,3,99,5,3,160,6,3,100
90 DATA 7,3,100,8,3,100,2,4,78,3,4,101
100 DATA 5,4,160,8,4,233,2,5,79,3,5,101
110 DATA 5,5,160,6,5,99,7,5,99,8,5,160
120 DATA 2,6,76,3,6,101,5,6,160,6,6,100
130 DATA 7,6,100,8,6,105,3,7,76,4,7,100
140 DATA 5,7,105
```

**Listing 2. Modifying Listing 1 to use row and column data.**

```
10 DIM OFF(8)
20 OFF(2)=40: OFF(4)=-1
30 OFF(6)=1: OFF(8)=-40
40 AD=33268: PRINT "[CLS]"
50 POKE AD,160
60 GET C$: IF C$="" THEN 60
70 IF C$="2" OR C$="4" OR C$="6" OR C$="8"
   THEN AD=AD+OFF(VAL(C$))
80 GOTO 50
```

**Listing 3. A 'chunky graphics' drawing program.**

```
10 DIM LC(8),TC(8),PC(15),OFF(8)
20 LC(2)=8: LC(4)=1
30 LC(6)=4: LC(8)=2
40 TC(2)=2: TC(4)=4
50 TC(6)=1: TC(8)=8
60 PC(0)=32: PC(3)=112: PC(5)=64
70 PC(6)=110: PC(7)=114: PC(9)=109
80 PC(10)=93: PC(11)=107: PC(12)=125
90 PC(13)=113: PC(14)=115: PC(15)=91
100 OFF(2)=40: OFF(4)=-1
110 OFF(6)=1: OFF(8)=-40
130 AD=33268: PRINT "[CLS]"
140 POKE AD,PC(5): LD$="6"
150 GET TD$: IF TD$="" THEN 150
160 IF TD$"2" OR TD$="4" OR TD$="6" OR TD$="8"
    THEN 180
170 GOTO 150
180 AD=AD+OFF(VAL(LD$))
190 J=LC(VAL(LD$))
200 L=TC(VAL(TD$))
210 Z=((NOT J) AND L) OR (J AND (NOT L))
230 POKE AD,PC(Z)
240 LD$=TD$
250 GOTO 150
```

**Listing 4. A drawing program using picture logic.**

```
10 DIM LC(8),TC(8),PC(15),RC(15),OFF(8)
120 FOR I=0 TO 15: RC(PC(I))=I: NEXT I
220 P=Z OR RC(PEEK(AD))
230 POKE AD,PC(P)
```

**Listing 5. These modifications to Listing 4 allow the program to 'look ahead' and preserve existing lines.**

produced when the values −1, 1 and −40 are stored in the fourth, sixth and eighth elements of the array containing the offset values. The drawing program is given in Listing 3. Drawings produced by this program will lack the variety that can be obtained with the earlier ones, but the program is much easier to use.

## PICTURE LOGIC

The rather crude drawings produced by the interactive drawing program can be improved considerably with the aid of a small picture logic system. The picture logic or picture language involves the 12 graphics characters shown in Fig. 5 and the ways in which they can be combined to form a continuous trace. The PET codes

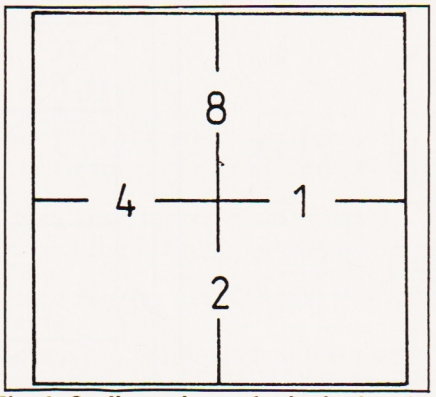


**Fig. 6. Coding scheme for logical codes.**

used, and so it is also necessary to be able to convert from one coding scheme to another.

The characters shown in Fig. 5 are to be used in drawing a continuous, high-resolution trace (that is, a trace that is one dot

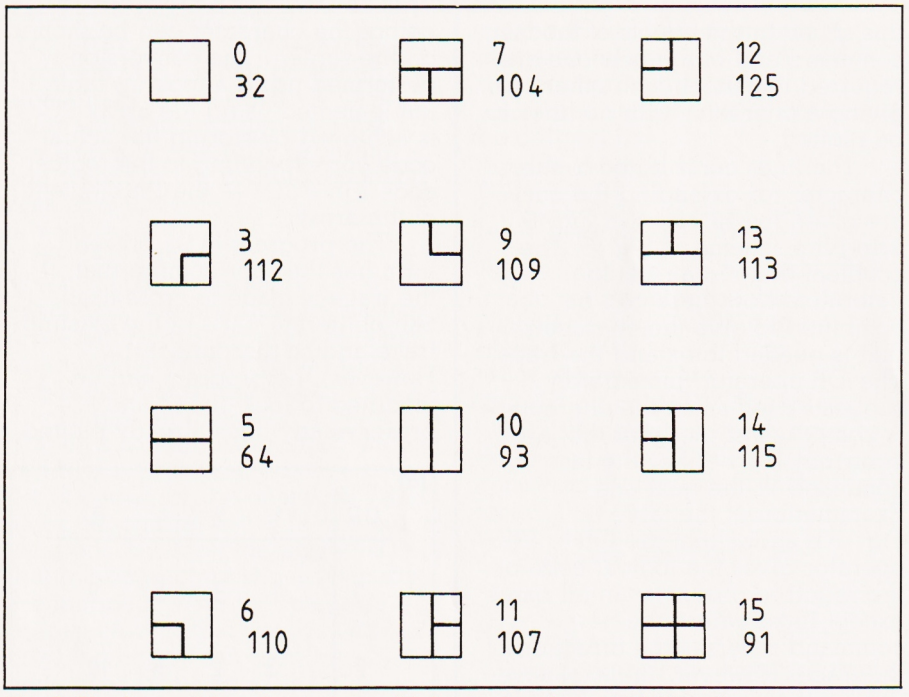


**Fig. 5. Block graphics characters with logical codes and PET codes.**

for generating each character using the POKE command are given, and also a logical code which can be systematically assigned to each character using the scheme illustrated in Fig. 6. Each character can be regarded as being composed of up to four lines, each of which emanates from the centre of the character and terminates at the middle of an edge. Each of these lines is weighted as shown in Fig. 6, and the logical code for a character is computed by adding the weighting values for each line that is present in the character. The logical code is introduced because it makes the development of the picture logic much simpler. When using this logic to produce displays on a microcomputer screen the codes for that particular micro must be

wide) on a block graphics screen. The trace is to be driven in any one of four directions in the same way as is used by the interactive drawing program given earlier. Figure 7 shows a typical trace given by the earlier program with the corresponding trace that we are aiming to produce.

When using these characters to generate a continuous trace there is a certain logic in the way that the characters are to be placed next to each other in order to extend the trace. The trace is always extended by plotting a character in the next position to be encountered in the direction in which the trace is already proceeding. So, to illustrate, if the trace was last extended to the right by drawing a horizontal line (with the logical code 5), then the next

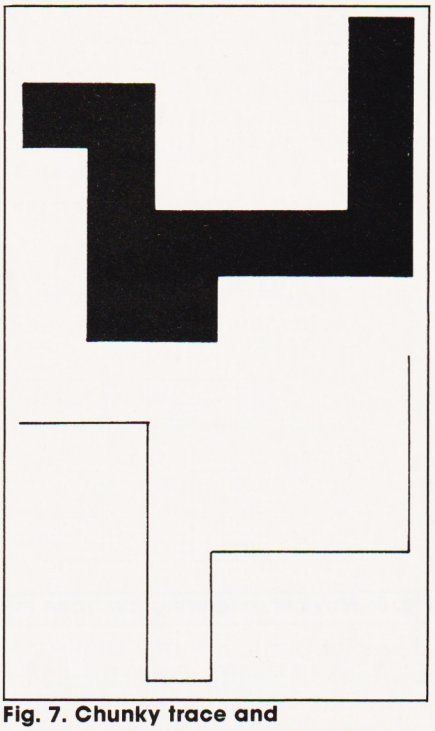

**Fig. 7. Chunky trace and corresponding high resolution trace.**

character will be plotted to its right and whatever command is given the next character to be plotted cannot be one of those with logical codes 3, 9, 10 or 11 because none of these will give a continuous trace. To write a program that can be driven interactively to produce a high-resolution trace, we must uncover the ways that characters can be strung together to make the trace. We can refer to this as a picture language because the rules for combining graphics characters to give sensible pictures are entirely analogous to the rules of a language which determine the ways in which words can be combined to make sensible sentences.

To uncover this logic we can observe that the key factors in deciding how the trace should be extended at any time are the direction in which the trace is progessing and the direction in which it is to be extended. The direction in which the trace is progessing is determined by the last command given, and the direction in which it is to be extended as governed by the next command. We should expect, therefore, that knowledge of the last command and the next command would be sufficient to determine which character should be drawn to extend the trace.

The ways in which the trace can be extended are given in Fig. 8. The last command is represented by LC, and TC indicates the current command which causes the trace to be extended when it is issued. The

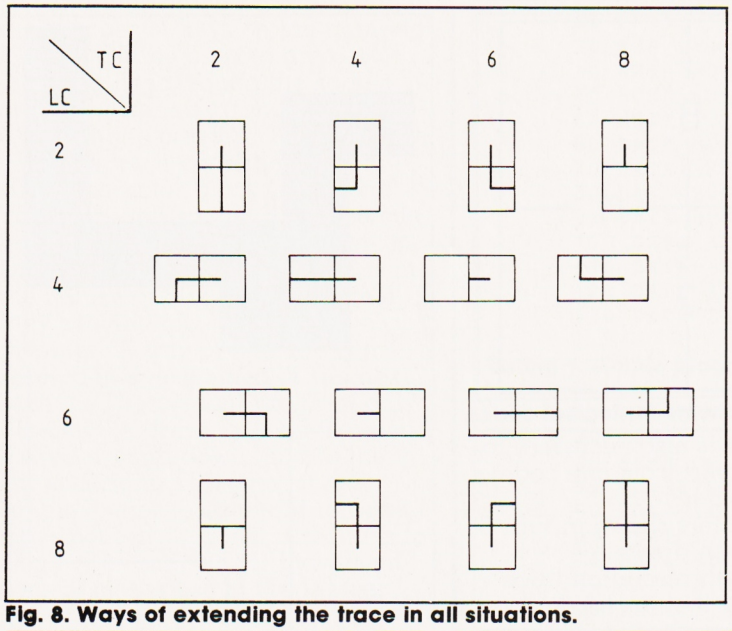


**Fig. 8. Ways of extending the trace in all situations.**

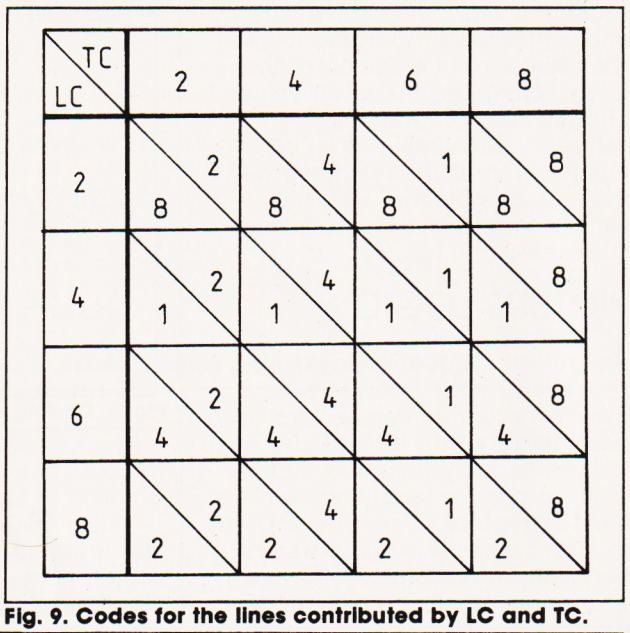


**Fig. 9. Codes for the lines contributed by LC and TC.**

character position with a single line from its centre shows the final part of the existing trace and indicates the direction in which it is progressing in response the LC. The other square shows how the trace can be extended in response to TC in all cases.

Examining the first row of the table (for which the last command was 2, so that the trace is proceeding downwards), when the next command is 2 a vertical line character can be drawn since the trace has only to be extended in the direction it is already taking. However in response to the new command 4, the direction taken by the trace must be changed from downwards to leftwards. This can be arranged by extending the trace using the character with logical code 12. Similarly the character with code 9 will effect a turn to the right. The final entry in the top row of the table records that if the trace is directed downwards and the new command requires it to be extended upwards then no extension is made to the curve. Actually, so that this situation is dealt with in the same way as the others, the blank character with logical code 0 is plotted.

The table shows that in general the trace is extended by continuing in the direction of the existing trace to the centre of the next character position and then drawing a line from the centre in the direction indicated by the new command. In this way the last command and the next one both exert an influence on the way in which the trace is extended. The only exceptions to this description of how the trace is extended occur when the new command reverses the direction of the trace, and in this situation the effects of the last command and of the new one are required to cancel each other out, giving a character with no lines to be plotted.

The lines contributed to the character for extending the curve are given for all cases in Fig. 9 using the scheme of Fig. 6. The problem that remains is to determine how these can be combined to give the character that is needed to extend the trace. The OR operator immediately suggests itself since the character is composed of the lines that are contributed by either the last command or the next one. Examination of the table in Fig. 10a shows that the OR operator gives the logical code of the required character in all cases except those where the new command reverses the direction of the trace. However, the exclusive-OR function tabulated in Fig. 10b provides the necessary logic.

The program in Listing 4, based on the same framework as the previous interactive drawing program but incorporating the picture logic we have developed, gives high-resolution traces. Lines 20 to 50 of the program incorporate the information given in Fig. 9. The variable J holds the code for the line contributed to the character for extending the trace by the last command, while L holds the code for the line contributed by the new command. The exclusive-OR of the values in J and L is implemented in line 210 using AND, OR and NOT since most BASICs do not provide this operator, and the result is stored in Z to give the logical code for the character to extend the trace. This code must be converted to the actual code for use with POKE before the character can be plotted on the screen. The conversion is performed using a look-up table implemented using the array PC. It is achieved by storing the actual code corresponding to the logical code I in PC(I) — the Ith element of the array.

The program in its present form has the shortcoming that, if the trace is made to cross itself, it can obliterate parts of the existing trace and so disconnect it. However, the program can be modified to look ahead and preserve any lines already plotted

**(a)**

| OR | 1 | 2 | 4 | 8 |
|---|---|---|---|---|
| 1 | 1 | 3 | 5 | 9 |
| 2 | 3 | 2 | 6 | 10 |
| 4 | 5 | 6 | 4 | 12 |
| 8 | 9 | 10 | 12 | 8 |

**(b)**

| XOR | 1 | 2 | 4 | 8 |
|---|---|---|---|---|
| 1 | 0 | 3 | 5 | 9 |
| 2 | 3 | 0 | 6 | 10 |
| 4 | 5 | 6 | 0 | 12 |
| 8 | 9 | 10 | 12 | 0 |

**Fig. 10 Table of values for OR and EXOR operators.**

in the character position where a character is to be placed to extend the trace. This can be done by modifying lines 10 and 230, and adding lines 120 and 220 as shown in Listing 5.

It should be noted that the improvement in resolution given by these programs is more apparent than real. Although the resulting trace is one dot wide rather than one character wide, the trace can be made no more detailed. Its main advantage is that its twists and turns are much more clearly marked since the different parts of the curve do not merge with each other.

## LISP

LISP is a language for processing lists. In LISP a list of items is written by placing the items between brackets, thus:

```
(PEN PENCIL RULER ERASER STENCIL)
```

The item of a list can be either elementary data or lists. A LISP program is also written as a list. For example, the LISP program equivalent to the BASIC command

```
POKE 32768,160
```

is written as

```
(POKE 32768 160)
```

When a LISP program is evaluated, the first item in the list representing the program is taken as a function to be applied to the remaining items in the list.

To plot an image on a block graphics screen using LISP, we can first represent the image by a list of codes for the characters and a corresponding list of the memory locations to which the positions that the characters should occupy are mapped. With the image represented in this way by two lists, the image can then be generated by using POKE.

A list of codes can be assigned a name by using the LISP function SETQ. The name CODE can be given to the list of the first few codes needed for the image in Fig. 1 by:

```
(SETQ CODE '(100 100 78 233 79 99))
```

Similarly, the corresponding list of locations in the screen memory can be named ADDRESS by:

```
(SETQ ADDRESS '(32771 32772 32810
32812 32850 32851))
```

The top part of the image in Fig. 1 can now be generated by applying POKE to the first item in each list and then the second and so on until the lists are exhausted.

The two fundamental list processing functions in LISP are CAR and CDR. When applied to a list CAR gives the first item of the list, while CDR gives the list with its first item removed. Thus:

```
(CAR CODE)
```

gives:

```
100
```

and:

```
(CDR ADDRESS)
```

delivers the result:

```
(32772 32810 32812 32850 32851)
```

The image can now be generated by:

```
(POKE (CAR ADDRESS) (CAR CODE))
```

to plot the first character, and then:

```
(SETQ ADDRESS (CDR ADDRESS))
(SETQ CODE (CDR CODE))
```

to remove the items that have been dealt with from the lists before repeating all three steps until the lists are exhausted. This procedure, although it illustrates the principles of generating a display using LISP, is not particularly convenient. However, LISP permits us to define functions of our own by using its DEFINE feature. With its aid a function named PLOT to plot an image represented by two lists A and B that contain, respectively, addresses and character codes can be defined by:

```
(DEFINE (PLOT A B)
(COND ((NULL A) NIL)
(T (CONS (POKE (CAR A) (CAR B))
(PLOT (CDR A) (CDR B))))))
```

Having defined this function, the image represented by the lists ADDRESS and CODE can be plotted by:

```
(PLOT ADDRESS CODE)
```

The definition of PLOT contains two LISP functions which need to be explained. COND is the conditional function. It takes the form:

```
(COND (test1 result1)
      (test2 result2)
            .
            .
            .
      (testN resultN))
```

When it is used the tests are made successively until one is found to be true (T), and then the result corresponding to this first successful test is the one delivered. NULL is applied to a list to see whether it is empty (that is, whether it contains no items). Applying NULL to any empty list gives the result true while applying it to any other list gives false as the result. Having explained these functions, the way that PLOT is defined can be stated informally as: 'To plot the image represented by the lists A and B, test if A is empty and if it is do nothing, otherwise apply POKE to the first item in each of A and B, and then recursively apply PLOT to the two lists with their first items removed'.

There is a simpler way to plot the image, although it involves the use of a more sophisticated function. This function is MAPCAR: it needs to be supplied with a function and a list, or lists, of arguments for that function. MAPCAR then causes the function it is supplied with to be applied successively to the items in the list, or lists. With its use our image can be plotted by:

```
(MAPCAR 'POKE ADDRESS CODE)
```

Now that we can produce images in LISP it is interesting to try to develop a drawing program. LISP does not have an interactive facility comparable to GET in BASIC, but a drawing program can be developed that is similar to the simple one given above in BASIC. Since the commands to drive the drawing head cannot be issued individually in interactive fashion, it should come as no surprise to find that they are to be provided as the items of a list.

Following the same conventions as in the earlier BASIC program, we can start by initialising AD with:

```
(SETQ AD 33268)
```

A function for handling any one of the movement commands 2, 4, 6 and 8 can be defined. It uses the LISP function EQ which tests whether its two arguments are equal. The definition is:

```
(DEFINE (MOVE C)
(COND ((EQ C 2) (POKE (SETQ AD
      (PLUS AD 40)) 160))
      ((EQ C 4) (POKE (SETQ AD
      (DIFFERENCE AD 1)) 160))
      ((EQ C 6) (POKE (SETQ AD
      (PLUS AD 1)) 160))
      ((EQ C 8) (POKE (SETQ AD
      (DIFFERENCE AD 40)) 160))
      (T NIL)))
```

Now when a list of commands is created by:

```
(SETQ COMMAND '(2 2 4 4 8 4))
```

the corresponding trace is produced by:

```
(POKE AD 160)
(MAPCAR 'MOVE COMMAND)
```

## SUMMARY

LISP possesses many functions of its own, but it also permits new functions to be defined to suit the programmer's needs. In this way the user can extend the language so that it is tailored to his needs. One of the keys to the successful use of LISP is the definition of the necessary functions. To program a task it is first broken down into sub-tasks. By writing functions to carry out the sub-tasks and then combining them into functions that perform higher tasks it is often possible to perform the original task by the application of a single function. However, this function is at the top of the pyramid of all the other functions of which it is composed.

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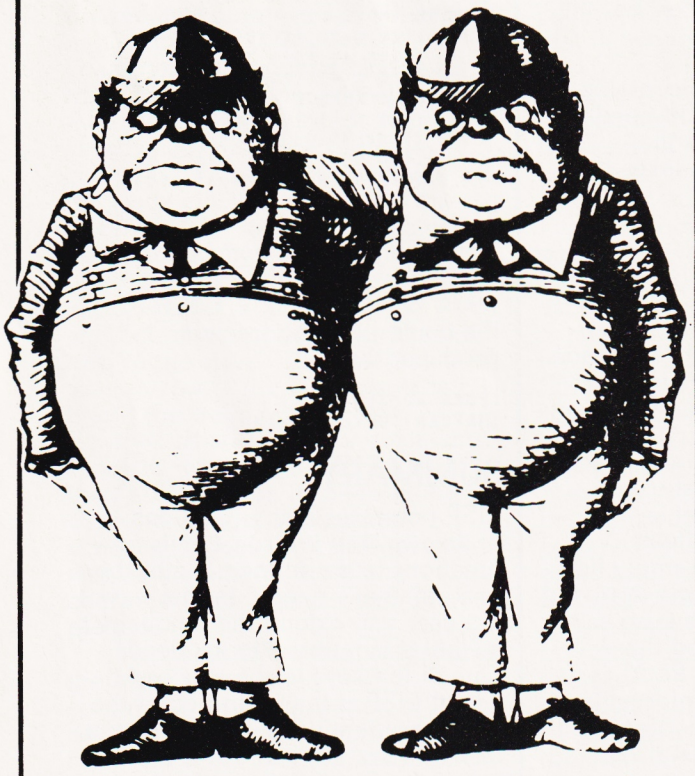

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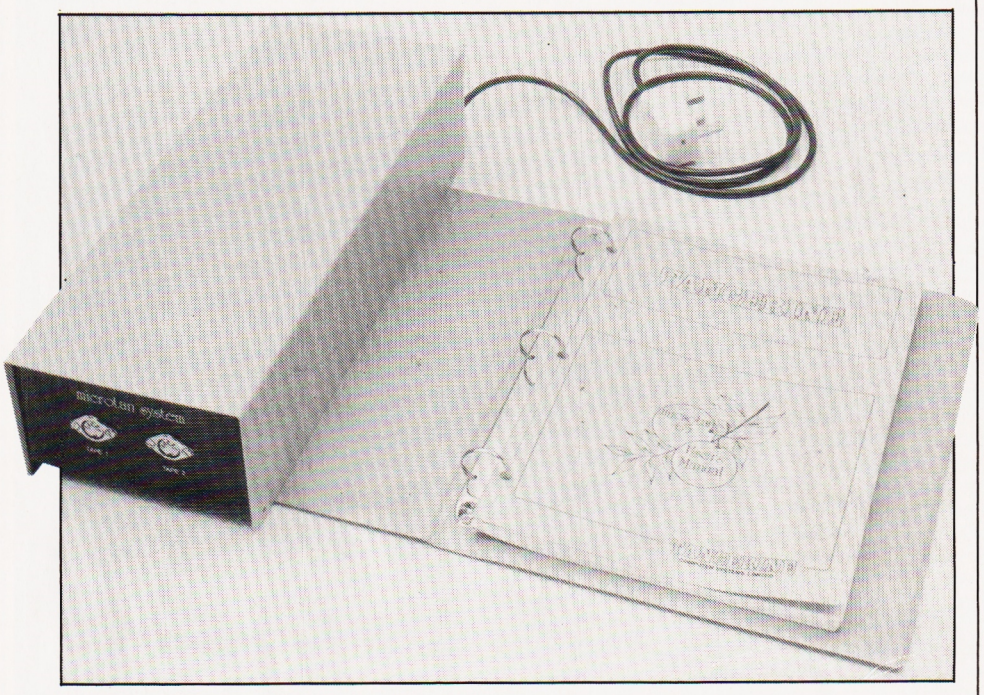
# NON-DESTRUCTIVE MICROTAN CURSOR

**Cursors — foiled again. Microtan's BASIC features a destructive cursor which makes typing errors tedious to correct. This article shows how to put things right.**



The Microtan computer uses a continuous, destructive cursor in its BASIC interpreter firmware. Whether typing data or text into a program, typing BASIC commands, using statements as direct commands, or typing lines of program, once characters have been typed (and before pressing <RETURN>) the only way of correcting an error in the line is to delete all characters up to the error, delete and correct the character then retype the remainder of the text once again.

There is an excellent editor for altering lines of program after entry but no similar way of correcting other types of keyboard input. (You could of course, provide data input correction facilities within a program).

I frequently find the very limited method of keyboard input correction rather frustrating and so set about devising a non-destructive cursor ('flashing cursor') routine which I could use within BASIC. The advantage of a flashing cursor is that you can step backwards or forwards 'over' characters already displayed on screen, delete or insert characters at any position within the line and return to the end of the line, yet leave the remainder of the characters intact.

There were a number of problems involved in writing the routine. One was that such 6502 assembly language as I understand has been completely self taught, largely by puzzling out other peoples' assembly code routines, then trying to implement them on my computer. However, the routine listed works without undue limitations and I hope that you enjoy using it and perhaps adapting it for your own needs.

## DOWN TO BASICS

There is little documentation on the workings of Microtan's BASIC interpreter (though this is slowly becoming available): therefore, some detective work was necessary on the way the interpreter deals with input. Unlike TANBUG and XBUG, the BASIC interpreter does not read and act on input displayed on the screen. As characters are read from the keyboard, they are written to an input buffer as well as to the screen. The input buffer takes up 80 memory locations in page zero starting at location 35 hex (53 decimal). When you press <RETURN>, Microtan gets to work on the characters in the input buffer, not those shown on the screen. The implication of this fact is that, once the flashing cursor routine is in operation, whatever alterations are made to the text on screen, identical changes must be made within the input buffer.

A further point about the input buffer is that index X in the CPU carries the number of characters entered to the input buffer. On exit from the flashing cursor routine index X must, therefore, carry this same information. During passage through the routine it is necessary to use index X for other purposes so the location labelled COPL in the User Manual, 1E hex (30 decimal), is used to carry the input buffer character count.

The TANBUG subroutine normally used to output characters to the screen (in TANBUG version 2) is also used to output these characters to a printer, one by one as they are received from the keyboard. With a non-destructive cursor the output-to-printer-on-receipt would result in a mixed-up line of characters on paper as the line of text is altered on screen. The flashing cursor routine adopts a different way of sending keyboard input characters to a printer. Only just before leaving the routine, following receipt from the keyboard of any control character, is anything sent to a printer (if connected); then the full contents of the input buffer is output at one time.

Within a BASIC program a '?' is output as a prompt when the program expects data or text to be input. This means that the characters received from the keyboard will be displayed on screen inset from the start of the screen character line. Microtan uses three page zero locations to point to the current cursor position. The address of the memory location corresponding to the start of the screen line within which the cursor is positioned is ICURS, 0A hex (10 decimal), low byte and ICURSH, 0B hex (11 decimal), high byte. The position of the cursor along the line is held in VDUIND, 03 hex (3 decimal), and this is loaded into index Y of the microprocessor prior to displaying a character at the cursor position. The value held in VDUIND is returned to zero each

**Listing 1. Complete listing of the Flashing Cursor routine.**

```
Subroutine to delete cursor and fill the remainder of BASIC's
input buffer with spaces.

1DEF  A403   CLREBF LDY $3       VDUIND   Delete continuous
1DF1  A920          LDA #$20              cursor.
1DF3  910A   MORSPA STA ($A),Y
1DF5  A24F          LDX #$4F              Fill remainder of
1DF7  9535          STA $35,X             BASIC's input buffer
1DF9  CA            DEX                   with spaces.
1DFA  E41E          CPX $1E      COPL
1DFC  10F9          BPL $1DF7    MORSPA
1DFE  E8            INX
1DFF  60            RTS


Subroutine to access 'Flashing Cursor' from BASIC.

1E00  48     ACCESS PHA                   Save registers on
1E01  8A            TXA                   stack.
1E02  48            PHA
1E03  98            TYA
1E04  48            PHA
1E05  A510          LDA $10      INTSL1   Transfer instruction
1E07  8D971E        STA $1E97    ENINT1   from slow interrupt
1E0A  A511          LDA $11      INTSL2   link to the exit
1E0C  8D981E        STA $1E98    ENINT2   from this routine.
1E0F  A512          LDA $12      INTSL3
1E11  8D991E        STA $1E99    ENINT3
1E14  A94C          LDA #$4C              Set up slow interrupt
1E16  8510          STA $10      INTSL1   with jump to FLACUR.
1E18  A92B          LDA #$2B
1E1A  8511          STA $11      INTSL2
1E1C  A91E          LDA #$1E
1E1E  8512          STA $12      INTSL3
1E20  A900          LDA #$0               Clear FLAFLG which
1E22  8DFD1F        STA $1FFD    FLAFLG   shows if 'Flashing
                                          Cursor' is activated.
1E25  68            PLA                   Restore registers
1E26  A8            TAY                   and return to BASIC.
1E27  68            PLA
1E28  AA            TAX
1E29  68            PLA
1E2A  60            RTS
The 'Flashing Cursor' interrupt routine.

1E2B  78            SEI                   Disable interrupts.
1E2C  48            PHA                   Save A and IY on
1E2D  98            TYA                   stack.
1E2E  48            PHA
1E2F  A501          LDA $1       ICHAR    If the key pressed
1E31  C906          CMP #$6               is <CTRL>F then
1E33  F005          BEQ $1E3A             continue interrupt.
1E35  ADFD1F        LDA $1FFD    FLAFLG   If FLAFLG is clear
1E38  F059          BEQ $1E93    RESTOR   then quit routine.
1E3A  861E          STX $1E      COPL     Save no. of
                                          characters held by
                                          input buffer in COPL.
1E3C  20EF1D        JSR $1DEF    CLREBF   Delete continuous
1E3F  EA            NOP                   cursor and fill
                                          rest of input buffer
                                          with spaces.
1E40  D8            CLD                   Rearrange locations:
1E41  18            CLC                   ICURS to contain
1E42  98            TYA                   address of start of
1E43  650A          ADC $A       ICURS    input shown on
1E45  38            SEC                   screen, and VDUIND
1E46  E51E          SBC $1E      COPL     to contain the
1E48  850A          STA $A       ICURS    current cursor
1E4A  A50B          LDA $B       ICURSH   position within the
1E4C  E900          SBC #$0               line of input.
1E4E  850B          STA $B       ICURSH
1E50  8603          STX $3       VDUIND
1E52  A501   IDCHR  LDA $1       ICHAR    Look again at the
                                          present character.
1E54  C906          CMP #$6               If it is <CTRL>F
1E56  F045          BEQ $1E9D    FLAFIX   branch to amend
                                          FLAFLG.
1E58  C908          CMP #$8               If <BACK SPACE>,
1E5A  F05F          BEQ $1EBB    BSLNK
1E5C  C909          CMP #$9               <TAB>,
1E5E  F05E          BEQ $1EBE    TABLNK
1E60  C915          CMP #$15              <CTRL>U,
1E62  F05D          BEQ $1EC1    UPLNK
1E64  C904          CMP #$4               <CTRL>D,
1E66  F05C          BEQ $1EC4    DWNLNK
1E68  C940          CMP #$40              <@>,
1E6A  F05B          BEQ $1EC7    CLNLNK
1E6C  C905          CMP #$5               <CTRL>E,
1E6E  F05A          BEQ $1ECA    ECHLNK
1E70  C97F          CMP #$7F              or <DELETE> then
1E72  F059          BEQ $1ECD    DCHLNK   deal with it.
1E74  C920          CMP #$20              If a text character
1E76  B058          BCS $1ED0    OPTLNK   then display it, else
1E78  A50A   ENDINT LDA $A       ICURS    return ICURS and
1E7A  48            PHA                   VDUIND to system's
1E7B  29E0          AND #$E0              normal configuration
1E7D  850A          STA $A       ICURS    and pointing at the
1E7F  38            SEC                   start of the line
1E80  68            PLA                   of input on screen.
1E81  E50A          SBC $A       ICURS
1E83  8503          STA $3       VDUIND
1E85  A200          LDX #$0               Send the character(s)
1E87  E41E   MORCH? CPX $1E      COPL     held by the input
1E89  F008          BEQ $1E93    RESTOR   buffer through the
1E8B  B535          LDA $35,X             character output
1E8D  2075FE        JSR $FE75    OPCHR    subroutine.
1E90  E8            INX
1E91  10F4          BPL $1E87    MORCH?
1E93  68     RESTOR PLA                   Restore registers.
1E94  A8            TAY
1E95  68            PLA
1E96  58            CLI                   Enable interrupts and
1E97        ENINT1  ?                     proceed according to
1E98        ENINT2  ?                     the instructions read
1E99        ENINT3  ?                     from slow interrupt
1E9A  EA            NOP                   link.
1E9B  EA            NOP
1E9C  EA            NOP
1E9D  ACFD1F FLAFIX LDY $1FFD    FLAFLG   If FLAFLG is set
1EA0  D006          BNE $1EA8    CLFLFG   deal with it, else
1EA2  8DFD1F        STA $1FFD    FLAFLG   set FLAFLG to
                                          activate routine and
1EA5  F00E          BEQ $1EB5    PKBD     branch to PKBD.
1EA7  EA            NOP
1EA8  A000          LDY #$0               Clear FLAFLG to
1EAA  8CFD1F        STY $1FFD    FLAFLG   deactivate routine,
1EAD  8401          STY $1       ICHAR    clear ICHAR,
1EAF  A9FF          LDA #$FF              display continuous
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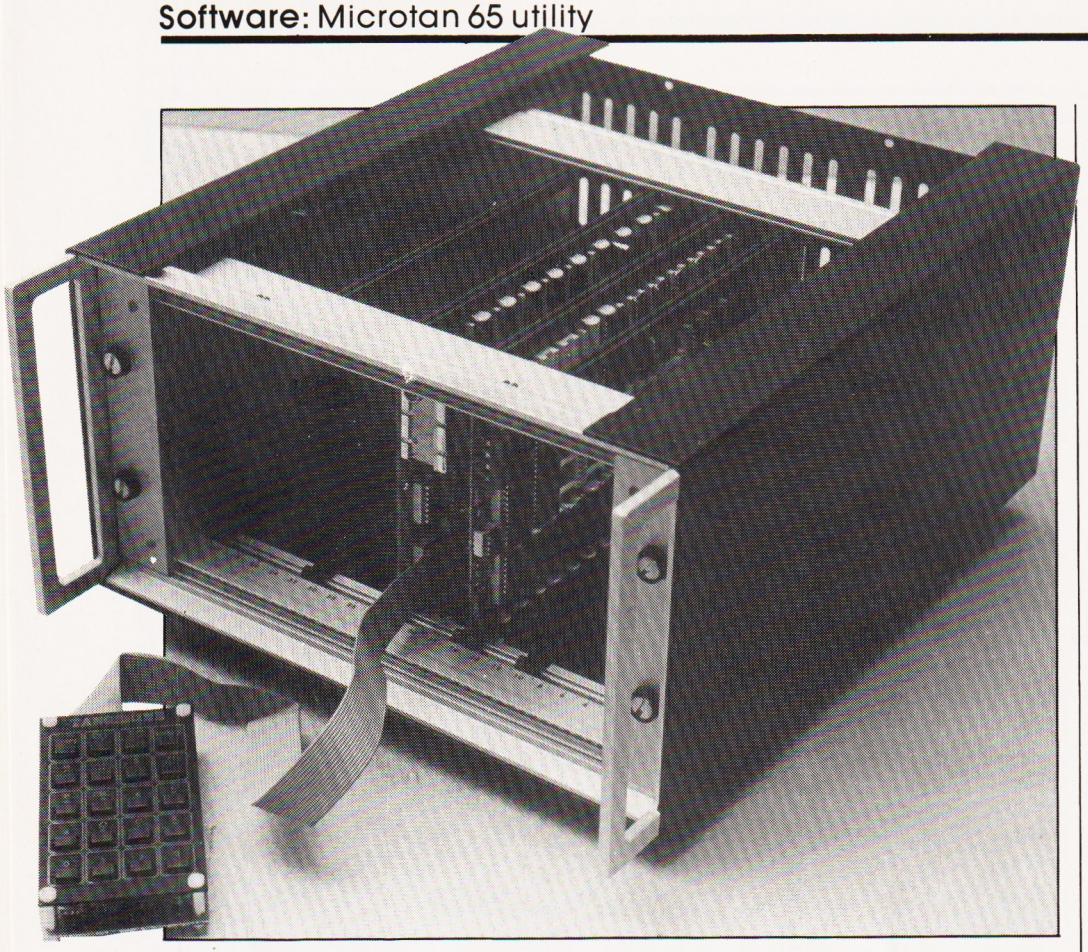

time the cursor moves to the start of the next screen text line. The value held in VDUIND does not normally therefore, exceed 1F hex (31 decimal).

Index X, you will recall, contains the total number of characters held in BASIC's input buffer. Since, within the flashing cursor routine, whatever changes are made on the screen to the line of text require identical changes within the text buffer, it is convenient for VDUIND to double as the position of the cursor within the text buffer as well as on screen. Because text/data received within a BASIC program is not likely to be written to the screen beginning at the start of the screen line then VDUIND would normally be greater than 0 at this point, yet index X would be zero at the beginning of input from the keyboard.

For VDUIND to serve as a pointer to the cursor both on screen and in the text buffer, then on entry to the flashing cursor routine both ICURS and VDUIND must be modified; ICURS to contain the actual address of the cursor at the start of data/text input and VDUIND to contain the number of locations on from ICURS that the cursor can actually be found. Readjustment of these locations is again necessary on exit from the flashing cursor routin. This readjustment is partially achieved automatically when the text held in the buffer is output via TANBUG's OPCHAR subroutine both to the screen (no change is evident to the user) and, more particularly, to any printer which may be connected.

The screen scroll subroutine used by Microtan also resets ICURS asnd VDUIND to the values which would be correct under normal operation. The chances are that those values would be wrong within the flashing cursor routine. Further, Microtan normally only scrolls the text on screen after a character has been printed to the cursor position at the last memory location allocated to screen display. Within the flashing cursor subroutine it is likely, as characters are inserted within an existing line of text, that a character will be written to that last location even though it is not the current cursor position. It is necessary, therefore, to provide a special subroutine to detect the various conditions under which the screen must be scrolled, do the scrolling and leave ICURS and VDUIND containing the appropriate values.

## DON'T INTERRUPT

Microtan normally obtains characters input from the keyboard via an interrupt routine coupled with the TANBUG's POLLKB subroutine. The interrupt routine does provide the means of adding to the command features provided by the BASIC interpreter: this is done by modifying the slow interrupt link provided at locations 10,11 and 12 hex (16, 17 and 18 decimal) and writing our own interrupt routine. Indeed, it is because of this method of passing characters from the keyboard to the Microtan that this flashing cursor routine is possible. However, normally each interrupt deals with a single character entered from the keyboard. Each new character entered generates its own interrupt.

In the flashing cursor routine one interrupt must serve to get the full line of characters from the keyboard onto the screen and into the text buffer. It is possible to nest interrupts but this would mean keeping a check on whether the system is on the primary, flashing cursor, interrupt level, or a secondary interrupt which would serve to get single characters from the keyboard through to the primary interrupt. If that sounds complicated then I agree, so I looked for another method of reading single characters from the keyboard while staying on the primary interrupt level.

TANBUG's POLLKB subroutine actually polls a page zero location, ICHAR, 01 hex (1 decimal), waiting until the interrupt routine that actually services the keyboard has read the keyboard input port, KBREAD, BFF3 hex (49139 decimal) and written the character to ICHAR. Instead of this approach it is perfectly possible to poll KBREAD directly, read the input character and write it to the screen and to the input buffer.

Taking this later approach means that interrupts must be disabled while the flashing cursor routine is in operation. It also means that the routine must recognise when a new key has been pressed on the keyboard. Once a key is depressed the keyboard sends the character to the input port, KBREAD, with the eighth bit set to 1. This is recognised as a negative number in the signed binary format. If this most significant bit is masked off (AND #$7F) and the result written straight back to the keyboard through the output port KBINCL, BFF0 hex (49136 decimal), then the data received at KBREAD goes positive (most significant bit is zero) and stays that way until another key is pressed. The flashing cursor routine thus recognises that a new key has been depressed despite disabling interrupts, because KBREAD goes negative following depression and this is tested for by the routine. Since interrupts are disabled while

```
1EB1  910A        STA $(A),Y
1EB3  D0C3        BNE $1E78    ENDINT   cursor and branch to
1EB5  20D31E      JSR $1ED3    FLASH    end the routine.
                                        Display flashing
                                        cursor and poll the
                                        key-board.  On
                                        character input
1EB8  4C521E      JMP $1E52    IDCHAR   jump to IDCHAR.
1EBB  4C791F BSLNK JMP $1F79   DOBS
1EBE  4C811F TABLNK JMP $1F81  DOTAB
1EC1  4C8B1F UPLNK JMP $1F8B   DOUP
1EC4  4C981F DWNLNK JMP $1F98  DODWN
1EC7  4CE81F CLNLNK JMP $1FE8  DOCLN
1ECA  4CC91F ECHLNK JMP $1FC9  DOECHR
1ECD  4CCE1F DCHLNK JMP $1FCE  DODCHR
1ED0  4C4E1F OPTLNK JMP $1F4E  OPTCHR
1ED3  A403   FLASH LDY $3      VDUIND   Read the character at
1ED5  B10A        LDA ($A),Y            the cursor's present
                                        position.
1ED7  8DFF1F      STA $1FFF    CUCHS1   Store it in CUCHS1
1EDA  48          PHA                   and on stack.
1EDB  A2FF        LDX #$FF              Store cursor
1EDD  8EFE1F      STX $1FFE    CUCHS2   in CUCHS2.
1EE0  8A     DISPCH TXA                 Display it on
1EE1  910A        STA ($A),Y            screen.
1EE3  A0FF        LDY #$FF              Set up IY and
1EE5  A2FF   DEL1 LDX #$FF              IX and delay before
1EE7  CA     DEL2 DEX                   switching character
1EE8  D0FD        BNE $1EE7    DEL2     for cursor. During
1EEA  ADF3BF      LDA $BFF3    KBREAD   delay read keyboard,
1EED  3015        BMI $1F04    GOTCHR   if key pressed branch
                                        to GOTCHR.
1EEF  88          DEY                   Else continue delay
1EF0  D0F3        BNE $1EE5    DEL1     until over.
1EF2  AEFF1F      LDX $1FFF    CUCHS1   Switch character
1EF5  ADFE1F      LDA $1FFE    CUCHS2   and cursor.
1EF8  8EFE1F      STX $1FFE    CUCHS2
1EFB  8DFF1F      STA $1FFF
1EFE  A403        LDY $3       VDUIND
1F00  C403        CPY $3       VDUIND   Unconditional jump to
1F02  F0DC        BEQ $1EE0    DISPCH   DISPCH.
1F04  297F   GOTCHR AND #$7F            Key was pressed so
                                        mask 7th bit.
1F06  8DF0BF      STA $BFF0    KBINCL   Reset keyboard.
1F09  8501        STA $1       ICHAR    Store character in
                                        ICHAR.
1F0B  68          PLA                   Fetch original screen
                                        character from stack
1F0C  A403        LDY $3       VDUIND   and display it at
1F0E  910A        STA ($A),Y            cursor position.
1F10  60          RTS                   Return.
1F11  18     NDSCRL CLC                 Check screen status
1F12  A50A        LDA $A       ICURS    to see if screen
1F14  6503        ADC $3       VDUIND   scroll is needed.
1F16  A50B        LDA $B       ICURSH
1F18  6900        ADC #$0
1F1A  C904        CMP #$4                If it is then branch
1F1C  F007        BEQ $1F25    SCROLL   to SCROLL.
1F1E  ADFF03      LDA $3FF
1F21  C920        CMP #$20               If not then skip.
1F23  F027        BEQ $1F4C    SKSCRL
1F25  A200   SCROLL LDX #$0              Move screen lines up
1F27  BD2002 MVUPTP LDA $220,X           one, top half first,
1F2A  9D0002      STA $200,X
1F2D  E8          INX
1F2E  D0F7        BNE $1F27    MVUPTP
1F30  BD2003 MVUPBM LDA $320,X           then lower half.
1F33  9D0003      STA $300,X
1F36  E8          INX
1F37  E0E0        CPX #$E0
1F39  D0F5        BNE $1F30    MVUPBM
1F3B  A920        LDA #$20               Fill bottom line of
1F3D  A8          TAY                    screen with spaces.
1F3E  88     ANOSPA DEY
1F3F  99E003      STA $3E0,Y
1F42  D0FA        BNE $1F3E    ANOSPA
1F44  38          SEC                    Adjust ICURS to point
1F45  A50A        LDA $A       ICURS
1F47  E920        SBC #$20               start of displayed
1F49  850A        STA $A       ICURS     input.
1F4B  EA          NOP
1F4C  18          CLC          SKSCRL
1F4D  60          RTS
1F4E  A51E   OPTCHR LDA $1E    COPL      Check there is room
1F50  C94F        CMP #$4F                in the input buffer
1F52  9003        BCC $1F57    MVCHRS    if so deal with
                                         character.  Else
1F54  4CB51E PKBLK1 JMP $1EB5  PKBD      jump back to PKBD.
1F57  AA     MVCHRS TAX                  If cursor is at end
1F58  A8          TAY                    of input line then
1F59  E403   CUPOS? CPX $3     VDUIND    branch to
1F5B  F00C        BEQ $1F69    STRCHR    STRCHR.
1F5D  CA          DEX                    Else move characters
1F5E  B535        LDA $35,X              in input buffer and
1F60  E8          INX                    on screen forward one
1F61  9535        STA $35,X              from cursor position.
1F63  910A        STA ($A),Y
1F65  CA          DEX
1F66  88          DEY
1F67  10F0        BPL $1F59    CUPOS?
1F69  A501   STRCHR LDA $1     ICHAR     Read input character.
1F6B  910A        STA ($A),Y             Write it to screen
1F6D  9535        STA $35,Y              and store it in input
                                         buffer.
1F6F  E8          INX                    Move cursor on one
1F70  8603        STX $3       VDUIND    location and increase
1F72  E61E        INC $1E      COPL      count of characters
                                         in input buffer.
1F74  20111F      JSR $1F11              Scroll screen, if
                                         necessary, and
1F77  90DB        BCC $1F54    PKBLK1    jump back to PKBD.
1F79  A403   DOBS  LDY $3      VDUIND    If cursor is at start
1F7B  F0D7        BEQ $1F54    PKBLK1    of input line then
                                         branch back to PKBD.
1F7D  C603        DEC $3       VDUIND    Else move cursor back
                                         one location then
1F7F  10D3        BPL $1F54    PKBLK1    branch back to PKBD.
1F81  A403   DOTAB LDY $3      VDUIND    If cursor is at end
1F83  C41E        CPY $1E                of current input then
1F85  10CD        BPL $1F54    PKBLK1    branch back to PKBD.
1F87  E603        INC $3       VDUIND    Else move cursor
                                         forward one location.
1F89  10C9        BPL $1F54    PKBLK1    Branch back to PKBD.
1F8B  A503   DOUP  LDA $3      VDUIND    If cursor is on 1st
1F8D  C920        CMP #$20               screen line of input
1F8F  90C3        BCC $1F54    PKBLK1    branch back to PKBD.
1F91  E920        SBC #$20               Else move cursor up
1F93  8503        STA $3       VDUIND    to previous screen
                                         line of current input
1F95  4CB51E PKBLK2 JMP $1EB5            and jump to PKBD.
1F98  18     DODWN CLC                   Check cursor if moved
1F99  A503        LDA $3       VDUIND    down would not be
1F9B  6902        ADC #$20               beyond end of screen
1F9D  C51E        CMP $1E      COPL      input display. If it
1F9F  F002        BEQ $1FA3    DOWN      wouldn't- do it. Else
1FA1  B0F2        BCS $1F95    PKBLK2    go back to PKBD.
1FA3  8503        STA $3       VDUIND
```

```
1FA5  90EE          BCC $1F95   PKBLK2
1FA7  B0EC          BCS $1F95   PKBLK2
1FA9  A603  ERCHR   LDX $3      VDUIND  If cursor is already
1FAB  A403          LDY $3      VDUIND  one location beyond
1FAD  E41E          CPX $1E     COPL    last character of
                                        input then
1FAF  F016          BEQ $1FC7   ENER    branch to ENER.
1FB1  E8    MVNXCH  INX                 Else move characters
1FB2  B535          LDA $35,X           beyond cursor back
1FB4  CA            DEX                 one location.
1FB5  9535          STA $35,X
1FB7  910A          STA ($A),Y
1FB9  C8            INY
1FBA  E8            INX
1FBB  E41E          CPX $1E
1FBD  D0F2          BNE $1FB1   MVNXCH
1FBF  A920          LDA #$20            Delete last character
1FC1  9535          STA $35,X           of line.
1FC3  910A          STA ($A),Y
1FC5  C61E          DEC $1E             Decrement count of
                                        characters in input
                                        buffer.
1FC7  18            CLC
1FC8  60            RTS
1FC9  20A91F DOECHR JSR $1FA9           Erase character and
1FCC  90C7          BCC $1F95           jump back to PKBD.
1FCE  A603  DODECH  LDX $3              If cursor is at start
                                        of input line then
1FD0  F0C3          BEQ $1F95           branch back to PKBD.
1FD2  B535          LDA $35,X           Else read character
                                        under cursor and
1FD4  48            PHA                 store it on stack.
1FD5  8A            TXA                 Store cursor position
1FD6  48            PHA                 on stack.
1FD7  20A91F        JSR $1FA9   ERCHR   Move characters
                                        beyond cursor back
                                        one location.
1FDA  68            PLA                 Retrieve cursor
1FDB  AA            TAX                 from stack and move
1FDC  CA            DEX                 it back one location.
1FDD  A8            TAY
1FDE  88            DEY
1FDF  68            PLA                 Retrieve character
1FE0  910A          STA ($A),Y          from stack and
1FE2  9535          STA $35,X           replace it under
                                        cursor
1FE4  8603          STX $3              Store new cursor
                                        position and
1FE6  10AD          BPL $1F95           branch back to PKBD.
1FE8  A41E  DOLNCL  LDY $1E             Replace all input
1FEA  A61E          LDX $1E             characters with
1FEC  A920          LDA #$20            spaces.
1FEE  9535  AGNSPA  STA $35,X
1FF0  910A          STA ($A),Y
1FF2  CA            DEX
1FF3  88            DEY
1FF4  10F8          BPL $1FEE   AGNSPA
1FF6  E8            INX                 Put cursor at start
1FF7  8603          STX $3      VDUIND  of screen line and
                                        input buffer.
1FF9  861E          STX $1E     COPL    Initialise input
                                        buffer character
                                        count.
1FFB  F098          BEQ $1F95   PKBLK2  Branch back to PKBD.

1FFD    FLAFL6
1FFE    CUCHS2
1FFF    CUCHS1
```

the flashing cursor routine is being executed, interrupts must again be enabled just prior to leaving the routine.

The flashing cursor routine must be compatible with the program statement editor provided within the BASIC EPROM. There would naturally be a conflict between the flashing cursor provided by that editor and the cursor of this routine. By using <CTRL> E as the character erase key within this flashing cursor routine, it is not possible to enter the editor while this routine is activated. Once the flashing cursor is deactivated (see below) then <CTRL>E following a line number activates the editor as normal.

Lastly, it is desirable that the flashing cursor routine should, as far as possible, be compatible with any interrupt routine contained within any extension ROM (socket E2 on TANEX) that might be intended for use with BASIC. Microtanic's TOOLKIT EPROM is such an extension ROM. The flashing cursor routine is accessed via a USR(X) call from within BASIC through a subroutine which reads the current contents of the slow interrupt link and writes this as the exit from 'flashing cursor' before writing the start address of this routine to the slow interrupt link. It is now possible, on leaving 'flashing cursor', either to end the interrupt or jump on to the interrupt routine held in the extension ROM.

## USING THE PROGRAM

The routine listed here is fully relocatable within RAM (if your have TANRAM), though the address contained by JMP instructions and JSR calls will require changing if you intend relocation. Once entered into RAM and MEMORY SIZE set at 7662 on entering BASIC, then the routine is accessed via:

```
POKE 34,0: POKE 35,30: P=USR(P)
```

Then <CTRL>F activates the flashing cursor, while depressing <CTRL> F again deactivates the routine. 'Flashing Cursor' may be activated or deactivated at any point during typing.

Since 'flashing cursor' is an interrupt routine then, even though it may be accessed and activated, the cursor will not flash until the first character of the input has been typed in at the keyboard.

Once the routine is activated then:
<BACK SPACE> does exactly that.
<TAB> moves cursor on one character.
<CTRL> U moves the cursor up one screen line provided that it would remain within the current text line.
<CTRL> D moves the cursor down with a similar restriction.
<CTRL> E erases the character under the cursor, while <DELETE> deletes the character to the left of the cursor, and <@> deletes the whole of the current line of text.

Pressing any other control character exits 'flashing cursor', and, unless that character was <CTRL> F, the next keyboard interrupt returns the system to 'flashing cursor'.

There are just a couple of limitations to the use of this routine: first, if you have TANBUG version 2 and wish to activate the printer from the keyboard (<CTRL> P or <CTRL> V), then this must be done before activating flashing cursor, or after deactivating the routine. Second, BASIC's editor may only be accessed if the routine is deactivated.

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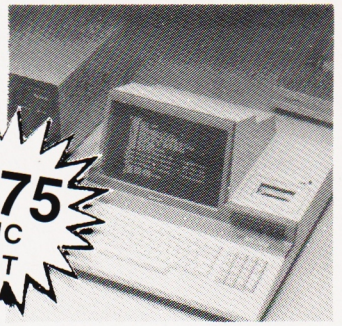

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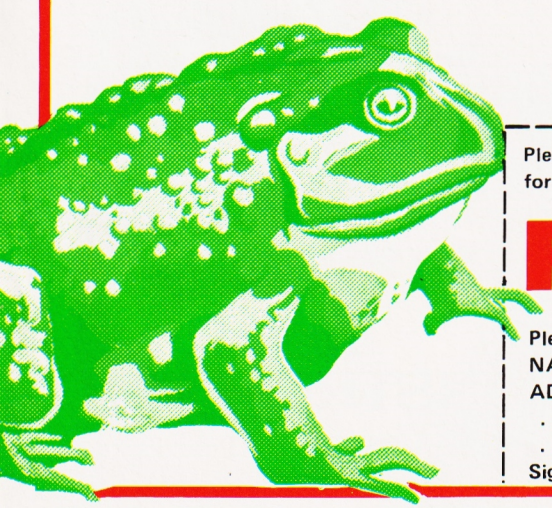

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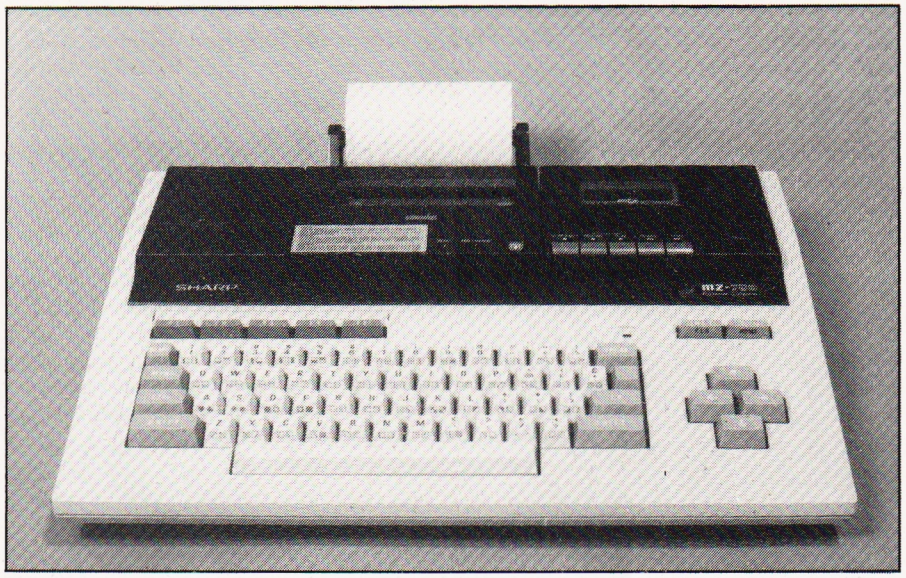
# LOOKING SHARP

## Sharp have looked at the home computer market, and their MZ machines, and decided to make some changes. Have they gone far enough?



Considering their sheer quality, it seems very strange that the Sharp MZ series of personal computers have not gained a greater share of the home market. We have had both an MZ-80K and an MZ-80A in the office for a considerable time and have seldom had cause to complain. To the best of my knowledge there has never been a hardware fault and indeed, one Sharp dealer who advertises in *Computing Today* boasts that he has never had a Sharp computer returned for service. How many other companies can make claims like that?

Granted, the MZ series are more expensive but the price includes a monitor and a cassette deck and the whole package is cased in a more attractive manner than the PET — a machine designed along similar principles but which somehow seemed to catch the imagination more. Part of the blame must be laid at the feet of Sharp, whose somewhat 'relaxed' attitude to marketing and software support has not done much to promote their products.

It appears that the message has finally got home to Sharp UK, for at their press launch for the home computer, they also revealed a new policy which can best be summed up as aggressive. Having realised that they have to push their products to make them sell, the MZ-700 will be on sale not just through the existing dealers but in branches of Dixons, Currys and other High Street electrical retailers. To get even more of an edge, Sharp are arranging one-day training courses for the sales staff of these shops so that they can sell computers more effectively (or more precisely they can sell Sharp computers more effectively!). Sharp even hope to get their handheld computers on sale in newsagents.

The company also knows that software support is vital to the sales of a new machine, so moves have been made on that front too. Some existing Sharp software will be sort-of-compatible (see later), and they intend fixing a price of about £3.99 for Sharp-approved software. They have also asked that approved software should be sold shrink-wrapped onto cards to fit their existing calculator point-of-sale stands.

Nevertheless, although all this will give Sharp a big edge, the important thing is still the machine itself. Despite the MZ tag, it looks different to the previous computers — closer examination reveals a mixture of innovation and conservatism. Is the mix the right one?

## FIRST IMPRESSIONS

The first thing you notice is that Sharp have dropped the built-in monitor: since the MZ-700 is a colour machine, including a screen would have sent the price through the roof. Consequently the 700 is more compact than its predecessors, being about the size and shape of an average portable electric typewriter. The actual size is 17¼"by 12" by 3½". The styling is excellent and results in a very attractive-looking piece of equipment. The case is made from rigid, impact-resistant plastic which is creamy-grey in colour, and sloped at the front for the typewriter-style keyboard. Behind the keyboard is a flat, dark grey area which either houses the dedicated Sharp peripherals — a cassette recorder and colour printer/plotter — or has blanking covers fitted if you've bought the basic machine.

Indeed, there are four versions of the Sharp 700. The MZ-710 and MZ-711 are identical except for the video output options and have neither cassette recorder or printer. The MZ-721 has the cassette recorder, while the MZ-731, the top-of-the range computer that we were supplied with for review, comes with the printer too.

Working from left to right along the back panel, we come first to the RF signal output jack (TV channel 36 as usual), a composite video output jack and an RGB output socket. (The 710 only has the RGB connector). Nestling somewhere in the middle of all this are a colour/black-and-white switch and a small screw adjustment for trimming the RF channel.

Below the video outputs are two standard 3.5 mm jack sockets labelled READ and WRITE, for use by people not buying the built-in cassette, and a shuttered connection point for two joysticks. Further right come two edge connectors, a large one labelled I/O and a smaller one for connection to an external printer. Both of these were firmly blanked off with steel plates, both of which we would have removed had we anything to plug into them. The printer port can be used without an interface card to drive the Sharp MZ-80P5(K) printer (we've got two Sharp printers but not that one!), but for some reason Sharp have put the changeover switch for internal/external printer inside the machine, soldered to the PCB under the plotter. If you fancy using both printers at once, perhaps to produce letters and documents on the external device and fancy graphs on the plotter, you have no choice but to dismantle the computer each time you want to change over. If I owned a 700, I'd be tempted to do a little relocation work with a soldering iron and mount the switch on the back panel — once the warranty had expired, that is!

The owner's manual appears to say nothing about the I/O bus, but if ▶

Sharp follow their usual practice you'll be able to connect a twin disc drive via an extra interface unit.

Further on we have volume control for the internal speaker, a hard reset switch, mains supply socket and grounding terminal and the mains switch.

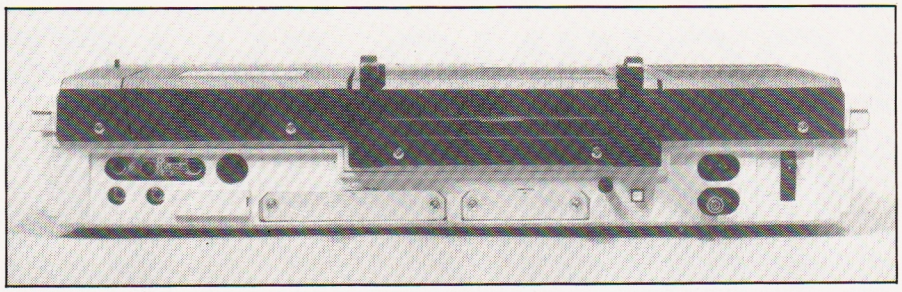
The keyboard is standard QWERTY, and uses quality switches, not membrane types or the 'calculator buttons' on the MZ-80K. The keytops have been moulded with a very fine texture which makes the keys feel almost as if they're clinging to your finger-tips; only prolonged use would reveal whether this is prone to collect grime. The alphanumeric keys are the same colour as the case, with the various control keys at the sides — Break, Shift, CTRL and so on — coloured yellow to set them apart. Oddly, there is an unmarked yellow key between Break and Carriage Return which appears to produce only the underline character. Perhaps aesthetics dictated its hue.

To the right of the main keys is a group of four sensibly-laid-out cursor keys, one for each direction: this is something of a relief as Sharp have previously used two keys only (with Shift) for cursor control, unfortunately changing their mind from model to model as to which direction the unshifted keys produced. Above the cursor pad are the Insert and Delete keys, which when shifted produce Clear and Home respectively. Since I'm used to Sharps where Insert is a shifted function I was continually clearing the screen by mistake when editing, but obviously a first time buyer wouldn't have this problem.

The final set of keys are to be found above the main keyboard and comprise five function keys which, together with Shift, give 10 user-defined keys. They are coloured blue for identification. For some reason, while every other key on the machine has its alternative (shifted) functions engraved on the front of the keytop, these five don't.

## USING THE MACHINE

So much for the guided tour — what's the MZ-700 like to use? Setting it up in my living room, I discovered that Sharp are a little skimpy on the cables. The mains cable is adequate, although not giving you the reach of the separate low-voltage supplies used by smaller computers; but the TV lead, at about 3' 6", is woefully short when you remember that it has to go round the back of the TV set. Valuing my sight too much to peer at a 19" screen from this distance, I used the lead from a ZX Spectrum instead.



**The rear of the MZ-700 is more generously supplied with sockets than some.**

It did occur to me to try the MZ-700 with the video monitor from the MZ-3541, which we also had in for review, since Sharp had been good enough to provide an RGB socket (other manufacturers please note). But something-or-other wasn't compatible with something else because all I got was a picture about 1" high in the centre of the screen. If you buy a monitor, even from Sharp, check it for compatibility before you part with the money.

Sharp bill the MZ-700 as a 'clean' machine. This is a polite way of saying you have to wait a long time after switching on before you can do anything, because there is no resident high level language and you have to load in the BASIC from tape. This takes 3 minutes and 9 seconds, which is about 3 minutes and 4 seconds too long in my opinion. The idea of a soft or clean machine is great for two reasons: RAM is faster than ROM so your computer can offer greater throughput, and alternative languages can be loaded where BASIC would normally be instead of wasting precious user RAM. However, there are better ways of doing this, even without disc drives. For example, the Cortex computer published by ETI last year has its BASIC in 'phantom' EPROMs, and when the computer is powered up it copies the BASIC from ROM to RAM, then disables the ROMs which take no further part in the proceedings. Result — instant high-level language in RAM about 5 seconds after switching on.

Things will obviously be a lot better once discs are available, though you will have to buy a new disc BASIC too. S-BASIC as provided with the MZ-700 has no DOS commands.

I would have tested the 700's ability to LOAD and SAVE with an external recorder, except that a jumper lead is required across the socket if the dedicated cassette is not being used and obviously the review model wasn't fitted with one. In any case, the dedicated recorder is so convenient and of such good quality that I suggest you splash out and get it regardless.

Being used to Sharps with built-in monitors, it was a trifle disconcerting to see the relative fuzziness of the TV display. However, compared to the displays generated by some other computers on domestic TVs the Sharp excels — colours are pure and there is no evidence of crawl, instability or other nasties. Evidently a good modulator is in use here.

## THE BASIC

The BASIC provided by with the machine, S-BASIC, contains very little to surprise anyone used to standard Microsoft, making program conversion from many other machines fairly easy. There are no structured commands such as REPEAT-UNTIL, WHILE-ENDWHILE or procedures, but nevertheless there are some pleasant surprises. Most of the 'programmer's friends' are present; MERGE, for example, which allows you to store various routines under different filenames on tape and string them together into other programs. This is a true MERGE rather than a APPEND, and a line in the machine will be overwritten if you merge a routine containing the same line number. Thus the RENUMber command will be useful in preventing such clashes, as well as allowing you to tidy up 'extensively developed' programs!

Other useful programming commands are AUTO and DELETE. AUTO has a novel feature I have not seen in other machines: should you reach a line number you have already programmed, the 700 displays not only the line number but calls up the whole line, reminding you it's there and giving the option of editing it or stepping over it. DELETE will delete blocks of lines and follows the same format as a LIST command. In fact the only omissions in the editing repertoire that I can think of are DUMP, to list variables currently in use, and FIND. The latter is just about the most useful utility I know for debugging, but I have given up expecting manufacturers to include it in their BASICs.

A limited musical ability is included — this uses two commands,

MUSIC and TEMPO, to generate simple monophonic sounds. No envelope-shaping is possible, but the commands are quite simple to use. MUSIC treats any following string as a series of notes or rests, over three octaves, and generates the corresponding tune at one of seven speeds, determined by TEMPO.

What else is nice? You can RESTORE to a line number, which can be very useful at times. Full error trapping is provided so that you can write your own error handling routines instead of dropping back into command mode with an error message. The LIMIT statement allows easy allocation of memory for machine code routines, accessed by a USR call and there's a full-feature monitor for more extensive machine code programming. Arrays may be declared with up to four dimensions. But still no IF-THEN-ELSE construction, sadly.

My status as a journalist led to the discovery of two more interesting facts, neither of which are documented in the manual for the benefit of the ordinary user. The first I learnt at the Sharp press launch, and since it's vitally important to the success of the MZ-700 it seems odd that no mention of it is made. Program tapes for the MZ-80K can be loaded directly into the MZ-700: once in, the computer puts up a message "CONVERTING TEXT", and converts the program so that it will run on the 700 in the default colours of white on blue. It is then possible to go through adding colour commands and so on to enhance the original. This means that Sharp purchasers will not be left in a software desert for the first few months of the machine's life, as happens with other micros. There is already a great deal of software available for the 80K which you can buy off-the-shelf.

I tried the obvious thing, of course, and loaded a tape for the MZ-80A into the 700. You still get the text conversion with one dot appearing on the screen for each line converted, but the finished program won't run. Every line starts with a REM, and while variable names, string constants and numerical data remain unaltered, something goes awry with the tokenisation and all keywords are replaced by graphics symbols or lower case letters. It's possible to load BASIC SA-5510 into the 700 and run 80A software that way, but you lose all the commands specific to the 700.

The second point of interest is that blanked-off joystick port. No mention of joysticks in the manual, or at the press launch. Then Solo Software of Worcester sent me some tapes for the 700, together with a rare 700 joystick which I managed to coax out of them. These are obviously not intended for UK release just yet as the accompanying leaflet was in Japanese; fortunately they have to program in English too, so I was able to glean the necessary information from the examples. There is provision for two joysticks, each of which has two fire buttons. The sticks are of the X-Y potentiometer type, not Atari switch-types, and contain rudimentary A-to-D converters. The various states of the sticks are accessed using the keyword JOY(n), where Table 1 shows the relationship between n and the parameter. The function apparently returns values of 0-255 for the X and Y values, −1 if a button is depressed and 0 otherwise. Division of the X and Y values by a suitable constant is required to scale them on to the screen (for example, 3.2 and 5.2 for an 80 by 50 resolution).

**TABLE 1**

| | |
|---|---|
| JOY(0) | Stick 1 (X) |
| JOY(1) | Stick 1 (Y) |
| JOY(2) | Stick 2 (X) |
| JOY(3) | Stick 2 (Y) |
| JOY(4) | Stick 1 (SW1) |
| JOY(5) | Stick 1 (SW2) |
| JOY(6) | Stick 2 (SW1) |
| JOY(7) | Stick 2 (SW2) |

**How to use the JOY command to read the joystick port.**

I found the joystick a little sloppy in use, though nowhere near as bad as, say, the Dragon 32 sticks. Since Sharp thoughtfully provide full circuit diagrams of both the computer and the joystick in their respective manuals, an enterprising user could probably interface something more to his liking here. Again, though, watch that warranty.

A further joyous (!) discovery was an example program written in something called Hu-BASIC. This had a WHILE-WEND statement in it! Come on, Sharp, what else does it have? And when are you going to release it?

## GRAPHICS

This is the first of Sharp's home computers to feature colour graphics. Given the current state of the consumer market, the decisions Sharp have made here seem a little odd. The 700 has no high-resolution mode — it still uses block graphics. The basic screen resolution is 40 characters by 25 lines, with 80 by 50 pixels if you utilise quarter blocks. To compensate for this, you do at least get an excellent set of predefined graphics characters: particularly useful since you cannot have user-defined characters. The size of the character set might or might not be twice as large as the usual 256 characters: a further 256 characters, giving a total of 512, has been designed by Graham Knight of Knight Computers, but the review machine was not fitted with this new ROM. To check if your machine has the extra shapes, POKE location 53248 (the start of screen memory) with a number between 256 and 511. If you get an unfamiliar character at the top left of the screen, you've got the new ROM. If you get an ILLEGAL DATA error, you haven't.

The screen memory is, in fact, a total of 4K in size. The first 2K holds the character codes, of which only 1K is displayed (40 by 25). Scrolling brings the remaining area into view, and may be done in one of two ways. Using the cursor keys alone, text which scrolls off the screen is lost. If you press Shift and the up or down keys, the 2K of screen memory wraps round and cycles through the display as if it were passing a window. Apart from anything else, this lets you edit listings in larger chunks than usual.

The remaining 2K of memory holds the corresponding data for the colour mapping. The coding used does not appear to be described anywhere in the manual, so if you want to POKE or PEEK colour codes rather than rely on the BASIC statements provided, Fig. 1 gives

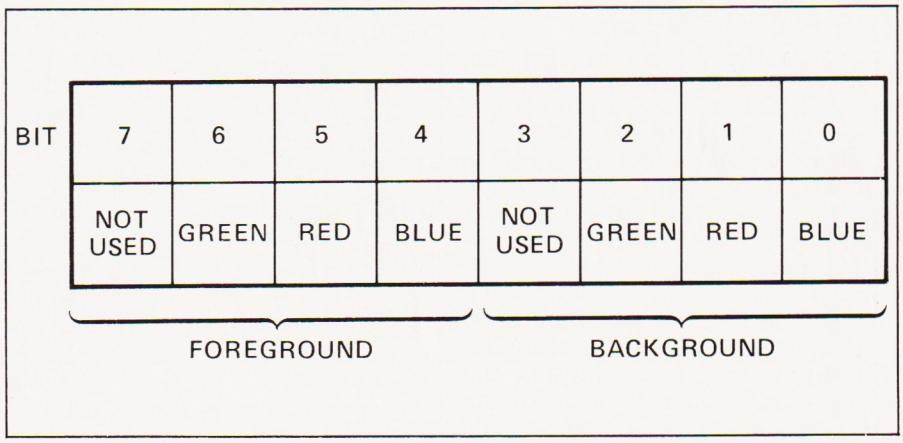



**Fig. 1. Coding for the bytes in the screen colour memory. With this you can PEEK and POKE, or access graphics from machine code.**

the details.

One unusual touch is that the command CONSOLE allows you to define a window anywhere on the screen in which scrolling will take place, while anything outside this area stays put. This could have some interesting applications in programs.

It is difficult to understand why Sharp have settled for any less than the current state-of-the-art in graphics. The company claim that compatibility with the 80K was a prime design criterion, but improvements could easily be made without sacrificing this. For example, if each of the 64 dots that make up a character block were individually addressable the screen would still support 40 by 25 graphics for 80K programs, but would be capable of 320 by 200 resolution. The memory requirement would be less than 24K and even at retail prices memory costs less than £1 per K. It wouldn't deplete the user RAM as the memory maps in the manual show that the video RAM is bank-switched and separate anyway.

Failing that, if you insist on loading the BASIC from tape into a 'clean' machine, why not go the whole hog and load the character set into RAM with the BASIC? Then user-defined graphics would be possible with a bit of judicious POKEing.

The point is not that block grphics are inherently bad: the Valley program published by CT has been a very successful game and only uses blocks, and this month's Languages In Use shows how versatile they can be. But nowadays the best-selling computers are ones like the Spectrum and BBC Model B: the average user obviously expects his machine to support high-res displays even if most people don't know how to use them to their full advantage. I hope people don't decide against buying the MZ-700 on this basis alone — but I suspect some will.

## THE PLOTTER

One of the outstanding features of the MZ-700 is the built-in four-colour printer/plotter. This little unit is almost-but-not-quite-the-same as the Tandy printer. The internal mechanism may be identical, but the housing isn't: needing a paper roll urgently for the front cover photograph, I dashed across the road to the friendly neighbourhood Tandy store to buy some of theirs. The width may be right, but the diameter is 70 mm and the maximum the Sharp holder can accept is 50 mm.

The plotter has a print head which holds four short biro pens, black, blue, green and red. You draw in one colour at a time and when a pen colour change is programmed, the head moves to the left and a ratchet rotates it to the correct position. Unfortunately the ratchet on the review machine was faulty and the head stuck between pen positions, making a true exploration of the device's potential impossible. Having seen the Tandy version working perfectly, and also the Sharp version at the press launch, I can only conclude that some damage had occured to my model prior to delivery (we know who had it before us, and they're not a million miles away in Oxford Street!).

S-BASIC has a large number of special commands specially for driving the plotter, which is just as well as it's not the easiest of beasts to interface with. There are several modes, these being 40 chars/line, 26 chars/line and an incredible 80 chars/line (the paper is only 115 mm wide!), plus graphics mode, in which charts and graphs may be drawn. Drawing commands include LINE and MOVE (absolute) and their relative counterparts, plus useful things like HSET (change the co-ordinate origin), AXIS (draws graph axes with scale markings), and CIRCLE.

My few attempts to produce meaningful graphs didn't work too well, as I had trouble getting the scaling factors right — an error in the vertical scale could push the paper right out the back of the plotter, while a horizontal error forces the pen against the end of its travel and, Sharp say, could lead to damage. I think I would need much more practice to become confident to transferring abstract equations into printouts with predictable results.

A word here about the manual. On the whole it's not too bad, despite several spelling mistakes (unforgivable in the names of keywords!) and the inevitable sentence of 'Janglish'. However, bits of it definitely need revision. One example is the definition of the CIRCLE command, which gives a set of limits apparently at variance with the maximum X coordinates. I decided to take the statement at face value and keyed in a command with all the maximum values. Reviewers are supposed to do things like that. Not surprisingly, the printer head tried to bury itself in the cassette recorder.

The plotter is an advanced piece of machinery, capable of some very versatile work, but needs careful thought about coordinate systems and scaling and some practice in its use before the best results can be obtained from it.

## CONCLUSION

The Sharp MZ-700 is a workmanlike computer which is very well-built and offers many interesting features. The accompanying benchmarks show that it is a fast machine: indeed, it outperforms all the competition except for the BBC Micro, including the Sirius 1. With the release of more peripherals it would form the basis of an excellent home system, but only time will tell if it will appeal to the mass market, who may not appreciate the finer points.

| BENCHMARK | BM1 | BM2 | BM3 | BM4 | BM5 | BM6 | BM7 | BM8 |
|---|---|---|---|---|---|---|---|---|
| TIME | 1.3 | 3.4 | 9.7 | 8.6 | 9.3 | 18.0 | 33.6 | 82.7 |

**Benchmark test results for the Sharp MZ-700. All benchmarks are for an iteration of 1000, and show the machine to be very fast.**

**FACTSHEET** Sharp MZ-700

| | |
|---|---|
| **CPU** | Z80A |
| **ROM** | 4K (ROM)<br>2K or 4K (character generator) |
| **RAM** | 64K (program area)<br>4K (video RAM) |
| **Language** | S-BASIC |
| **Keyboard** | QWERTY plus cursor pad and function keys |
| **Display** | Text: 25 lines of 40 characters<br>Graphics: 80 by 50; eight colours |
| **Cassette I/O** | 1200 baud |
| **Sound** | Single channel |
| **Costs** | £250 (no accessories)<br>£420 (with all accessories)<br>£130 for printer/plotter<br>£40 for cassette recorder |
| **Supplier** | Sharp (UK) Ltd, Sharp House, Thorp Road, Manchester, M10 9BE. |

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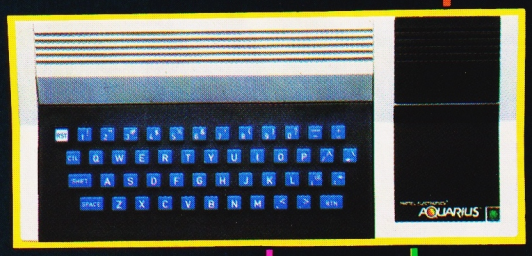
● *With twin cartridge ports, the mini-expander allows simultaneous use of additional RAM and software cartridges. Twin disc game hand controls are included and the unit provides two additional sound channels. The 16K RAM cartridge plugs into either the console or the mini-expander, increasing Aquarius™'s RAM capacity to 20K.*

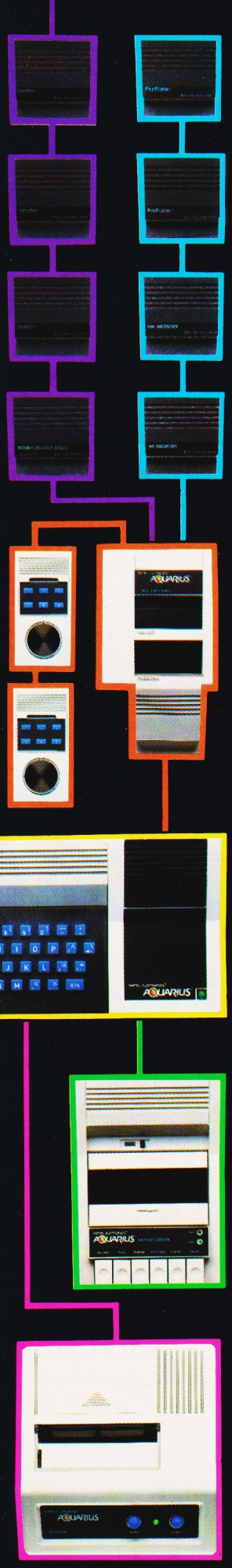
● *With the ability to reproduce the entire graphic and character set of Aquarius™ at 80 characters a second, the printer's 40 column output allows transcription of the complete monitor image.*



● *Using standard audio cassettes, the data recorder provides storage for programs and information, and allows the use of cassette based software. Incorporating a digital tape counter and transmission indicator, it operates sequential searching.*

● *A large number of games, designed to take advantage of Aquarius™'s sophisticated colour and sound capabilities, are available on cartridges that plug into the console either direct, or through the mini-expander. Cassette based games can be used via the data-recorder.*

● *A wide range of preprogrammed cartridges is available, including the LOGO teaching program and practical home data systems like FILEFORM™ and the spreadsheet calculator package, FINFORM.™*



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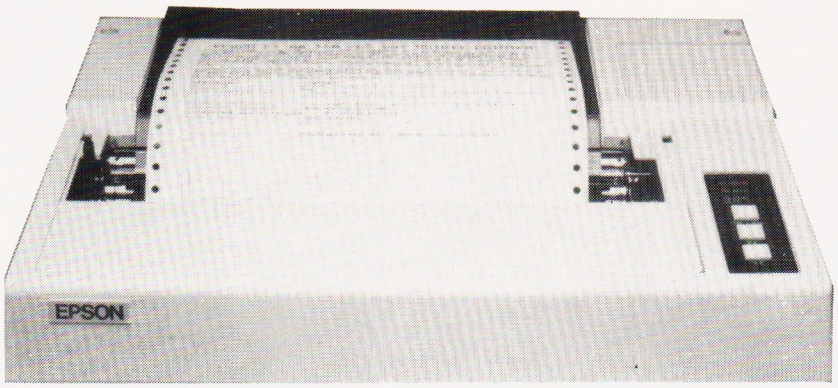


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# SHARP BUSINESS PRACTICE

**The second of our Sharp machines for review this month is another MZ computer, the MZ-3541. It's intended for the business user, but does it make the grade?**

If first impressions count for anything, the Sharp MZ-3541 should be a winner. The styling is attractive, with the main unit housed in a solid metal box that is amply strong enough to support the separate display unit, and a slim keyboard that looks and feels efficient. All this induces a favourable frame of mind for the investigation of the system in more detail. It is difficult to believe that there could be anything wrong with such good-looking equipment.

The Owner's Manual is good, too, one of the best we have seen for any microcomputer. Its 70 pages were packed with useful information, and our only doubt concerned the ability of some owners to understand the more abstruse sections. In some degree, it could be called a Technical Manual, since it contains quite a lot of detailed technical information.

Armed with this data, connecting the system up was simple and straightforward, with perhaps one exception. Underneath the main unit is a hole giving access to a set of switches used to select optional features. These include the type of printer in use, the choice of . or , for a decimal point, and the way the shift control acts. As set at the factory, the standard for countries outside the USA and Canada give upper case unshifted, and this was a little surprising, as it does not match usual European standards. It apparently meets Sharp standards, however, and these proved to be slightly independent in a number of respects.

The keyboard plugs into the front of the main unit, the display plugs into one of the twin display outputs at the rear, and we were ready to go.

## CONFIGURATIONS

It should be said that the system had been configured in advance, there being a number of possible arrangements. For example, the Graphics Board had been fitted, this being additional to the basic system. It slides in just below the disc drives, and the Owner's Manual gives detailed instructions for setting it up, including the way to plug the ICs into their sockets, and how to protect the board against static charges by wrapping it in tinfoil. Some kinds of owner we can envisage would perhaps be better off without such information!

Another variation involves the amount of RAM provided, which starts at 64K bytes, is extended to 128K bytes for the 3531 and 3541 systems, and can ultimately be expanded to 256K bytes. The basic single disc drive is augmented by a second in the 3540 and 3541 models.

Simple extras include a light pen, extra drives mounted externally (up to a total of eight), and an expansion unit, which is needed for memory extensions beyond 128K and also provides for additional interfaces. There is a printer output and an RS232C serial interface.

So much for the outward specifications. Looking further inwards, there are no less than three processors. One Z80A acts as the main CPU, another looks after peripheral activities, the two being coupled by 2K of common RAM, with shared access to the Initial Program Loading ROM. The peripheral processor has its own 8K of RAM, and more RAM is provided for the display, so that the 256K of RAM is all real, all usable.

The third processor is an 8049 serving the keyboard.

With this ample system the processing capacity is clearly quite large. The main CPU can chat away to the discs and main memory while the secondary CPU looks after the interface chores, reads the battery maintained calendar clock when necessary, and generally does the housekeeping. It was time to switch on and find out if the performance matched the expectations raised by the system specification.

## POWER ON

The first slight doubt arose when the instructions insisted that a disc had to be locked into the right-hand drive before power was switched on. Now, standard teaching says that discs should be inserted after power up, not before. No doubt these drives are protected well enough to make this rule unnecessary, but the difference could confuse anyone using more than one type of machine, and could possible induce bad habits. A small point, but one with practical implications. Our own habits led to us doing the 'wrong' thing, and the machine still booted as normal.

The discs which had been supplied were demonstrators, and very effective they were in that role. The coloured drawings of Japanese costumes, each area coloured independently, were alone worth the price of admission. The front cover ▶

photograph doesn't do them justice.

A slight snag then arose, however. A stack of business programs running under CP/M 2.2 had also been made available, but they lacked the actual CP/M records, and it was necessary to add these before the discs would run. Detailed searches through the documentation, however, failed to unearth information as to how this could be done. This may have been ignorance on our part, but the documentation should have enlightened us.

We endeavoured to fill the gap by creating some fresh programs to test out various system features, but before describing the conclusions which we drew from them, it will be appropriate to look at the various parts of the system in greater detail.

## THE DISPLAY

The '12"' colour monitor, which gave an 11" visible diagonal, is shown sitting on top of the main unit in all the illustrations, so presumably the fact that its base then obstructs two of the four ventilation grilles on top of the main unit is unimportant. The mounting allows for adjustment of the screen position in swivel and tilt, and this proved very convenient.

The display resolution is quoted at 640 by 400 dot elements, and we saw no reason to dispute this. Text options offered 40 or 80 column working, with 20 or 25 lines, the larger number of lines entailing omission of a blank line between character rows.

There was a slight confusion over the number of independent screens available, which depends on the graphics options incorporated. With the graphics board alone, the monochrome screen is implemented. Adding one set of memory chips provides a second monochrome screen, and another set of chips provided a third monochrome screen or a single colour screen. However, it was possible to use two screens for colour and the third for independent monochrome. Reverse video and flashing displays were implemented, though the method of controlling the latter seemed to present some problems.

The graphics and colour facilities are bewildering in their complexity, with four intensity levels for each colour, mixing of colours by use of interlaced dot patterns, and so on. It would almost have been a relief to have been limited to a monochrome green display, as provided by the alternative monitor.

Incidentally, the two monitor outputs can be used with two colour displays, two monochrome displays, or one of each.

## THE KEYBOARD

Four different types of keyboard are available; American English (ASCII); European English (ISO); German (DIN); and French (ISO). We had the European English variety, but the keyboards all appear to have the same layout and mechanism, the differences being confined to the keytops and coding.

First, there is the QWERTY core, with the usual Shift, Control, Enter, Tab, Home and arrow keys. Tab was rather awkwardly placed at the left hand end of the space bar, and rather more tabs were generated than were intended.

The control keys may look normal, but some of them act in a rather unusual manner. Shift works more or less as usual, subject to the state of the Shift Lock key (which incorporates a warning light) and the switch under the main unit which was mentioned earlier. Control modifies the action of other keys, and generates graphic character codes from the main keyboard. CMD causes the next key pressed, if within a particular group, to generate a command word. The manual itself seemed to become confused regarding the functions of some of the arrow keys, but down arrow appears to clear an input line, while Control Home clears the screen.

There is a separate numeric keypad, with its own Enter and =Enter keys, the latter changing the sign of the response to an INPUT or KEYIN statement. Close to the pad is the CL key, which can be used to clear a program line in junction with Enter, or to escape from an error situation.

Above the keypad are the program control keys, which allow a single key to be called to invoke RUN, CONTINUE, BREAK, EDIT, DELETE, INSERT, and to call DEBUG. The same key is used for BREAK and CONTINUE, Control CONTINUE giving BREAK. If you see what we mean...

To the left of these keys are 10 programmable function keys, and right in the left hand corner is a mode select switch that chooses either the program mode or the operation mode, the difference being that BASIC programs cannot be entered or edited in operation mode, and are therefore protected.

A useful feature is that the program control and function keys are surrounded by removable plastic overlays, which allow the keys to be labelled. Even with this, it was felt that a special training program covering the use of the keyboard would not come amiss...

## THE BASIC

Some doubts began to creep in when the BASIC system was brought into use. To begin with, the 'BASIC Language Manual', a massive affair of some 376 pages, proved to be laid out in a rather confusing way, mixing FDOS commands with true BASIC, and quoting the keywords — nearly two hundred of them — in a somewhat random manner. The Appendix, in a separate booklet, was a little more coherent, but still not easy to use.

Reference to these documents was essential, because there were unfamiliar usages involved. Instead of PRINT, the word was DISP. That, we learned by chance, is just another Sharp Special. There were some other similar oddities, but what was more significant was another Sharp Special, which recognises keywords in the middle of text strings. Try using NORTH as a variable, and the machine assumes that you mean N OR TH. Normally, it is enough to ensure that a variable name does not start with a reserved word, as the name is truncated to two letters. The Sharp method makes selection of valid variable names quite difficult, as there are so many letter combinations that must be avoided.

Next, the BASIC was SLOW! Not just a little off the pace, but positively crawling. Down among the pocket computers for some of the benchmarks, slower than a 2.3 MHz Z80 machine running the same routines in 8K Microsoft. Presumably MBASIC running under CP/M would be quicker, but we weren't able to check that.

Another objection to the BASIC was that there were no default values, and all the parameters had to be entered, even where that meant repeating the same figures again and again. To be fair, a Sharp user assured us that this was normal Sharp practice, but that made it no less annoying. An example is that scrolling the whole screen left requires as many parameters as are required for scrolling a 10 by 10 block in the middle. For programmers paid by the yard, this may not be important. For those who have an awareness of the value of working time, it is less acceptable.

The incidence of what has been called Janglish in the manuals was not too frequent, but remarks like 'Plots or erases a circle, ellipse, or part of these them' did not inspire confidence in other slightly obscure passages. Is the CIRCLE command really limited to the creation of

circles and ellipses with major axes vertical and horizontal? Is it essential that in assigning colour to text the exact number of letters involved must be predicted? Is there no way round the limitation of PEEK and POKE to the 9600-CFFF range? What is the point of such a limitation, when anyone wanting to examine or set other store areas can do so via machine code?

Frankly, we didn't like the BASIC, and we found the mixture of BASIC with FDOS confusing. That said, it had many unusual capabilities, and with a longer time to study them we might have considered that the problems were worthwhile. The programs that were created were not uninteresting, but the effort required was more than had been expected.

## MUSIC

It seemed rather strange to find a music facility in a machine clearly intended to be suitable for a serious business user, but this is no doubt a matter of ancestry, described in a demonstration as being out of PC-3201 by MZ-80B, though it isn't quite expressed in those terms. To a musical ear, the notes were stilted, and an attempt to program 'The Sound of Silence' had to be abandoned because the necessary note lengths were not available. However, the system is quite usable for warning tones and the like.

## OVERVIEW

In this instance, a fair assessment of the system is only possible on a basis of entire separation between the hardware and the software supplied with it. This is possible, because the Sharp is a 'soft' machine, all but the Initial Program Load routines being held in RAM, whereas in a 'hard' machine, with the BASIC interpreter in firmware, the programs used are more difficult to change.

Given that a comprehensive BIOS has been written for CP/M, there should be no insurmountable difficulty in using an alternative BASIC, and that could transform the machine. The extra instructions needed to control graphics and sound would have to be built in, but that should not be too difficult.

The hardware configuration, freed of the constraints of the BASIC interpreter, should be relatively fast, probably about twice as fast as these benchmarks suggest, and perhaps more. The ability to 'spit' a couple of thousand bytes at the peripheral system, to be handled by the secondary processor, should allow the main processor to get on with its job efficiently, though it should be remembered that two identical processors working through common memory will not be twice as powerful as a single processor of the same type, due to the time they have to spend talking to each other.

Briefly, then, a machine of interesting potential, hampered by a slow BASIC and by adherence to unusual standards that could be abandoned with advantage. Dedicated Sharp users may be surprised at this verdict, but this was our first contact with the make, and we have judged it against much broader standards.

| BENCHMARK | BM1 | BM2 | BM3 | BM4 | BM5 | BM6 | BM7 | BM8 | Average |
|---|---|---|---|---|---|---|---|---|---|
| TIME | 2.6 | 11.6 | 28.9 | 28.9 | 32.3 | 52.7 | 86.1 | 149.9 | 49.1 |

**Table 1. Benchmarks for the Sharp MZ-3541 (honest!).**

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# sinclair special 4

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Welcome to another Sinclair Special. Even if you're not yet a Sinclair owner; I believe you'll find something of interest in this latest issue.

For instance, if you're looking for the best way to begin computing, turn to our back page. You'll see that leading Sinclair retailers are now offering the popular ZX81, complete with a 16K RAM Pack *and* a free software cassette, all for £45. That means savings of at least £29 on one of the world's all-time best-selling computers.

Those same retailers are also offering the ZX Printer at its regular price of £39.95, but accompanied by a *free* 5-roll Paper Pack, worth £11.95.

If you want to add even more speed and versatility to your ZX Spectrum system, you'll be pleased to hear that the new ZX Microdrive has now been officially announced.

Microdrives are being released on an order of priority basis. Spectrum owners who purchased direct from us will be sent order forms, in a series of mailings that begin with the earliest names on our list of Spectrum owners. If you didn't buy direct from us by mail order, send us your name and address (use the coupon in this Sinclair Special). We'll add your name to the list, and send you a colour brochure and details on how to order.

Finally, if you're looking for more ways to use your ZX system, take a look at the software opposite. There are programs for programmers, a space-chase and car race for arcade-game players, a brand new logic game for those who've exhausted 'the cube.'

The Cattell IQ Test is based on the definitive professional psychologists' test – and forms an accurate but easy way of measuring your own IQ. All the new programs are available direct from us, through the order form in this issue.

You'll see what I mean about Sinclair having something for everyone. And we'll have even more to show you at two forthcoming exhibitions: the PCW Show at the Barbican Centre, from September 28th to October 2nd, and the Great Home Entertainment Spectacular at Olympia, from September 17th to 25th.

Nigel Searle

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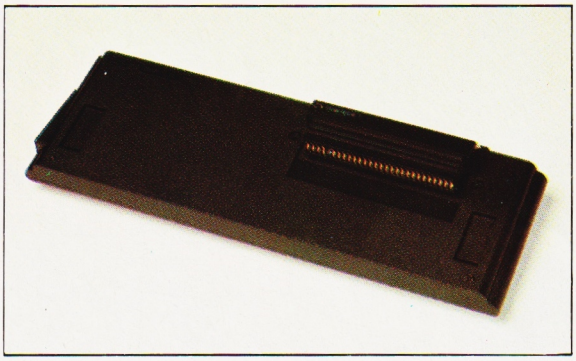

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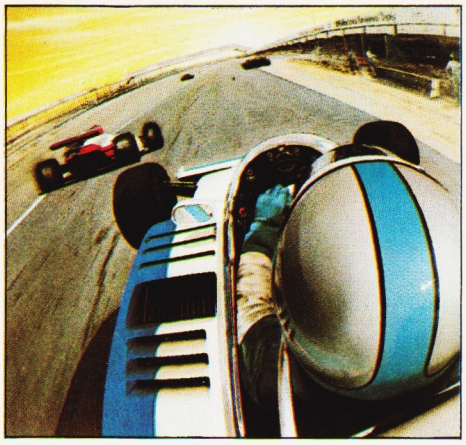

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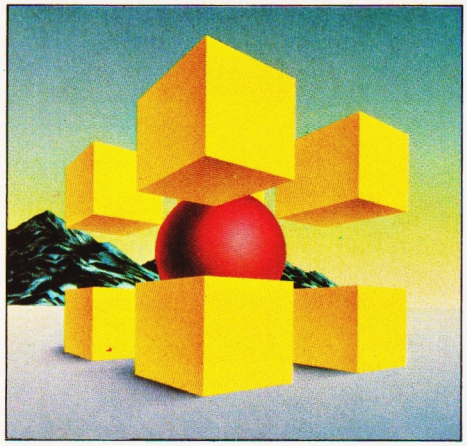

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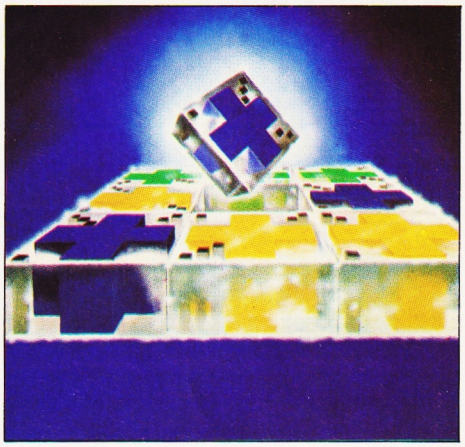

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# Z80 DISASSEMBLER

**This BASIC program lets you look at any machine code program in memory by decoding it into mnemonics and data. Written on the Nascom 2, it is easily converted for other machines.**

Suppose you send off your cheque to the Intergalactic Software Corporation and, after waiting eagerly each day for the postman, find that their wonder program is not quite what you had hoped. Or suppose you write an extremely clever enhancement to your machine's monitor, blow it into a ROM, and when you think of a very desirable improvement a listing of the source is nowhere to be found.

In either case you will find yourself poring over a list of hex bytes trying to decide what they do. It's not easy; Leventhal's **Z80 Assembly Language Programming** contains a list of all the Z80 instructions in numerical order, but since they are listed as a mixture of hex and binary and the instructions may be from one to four bytes long (some of which may be data), using it is a short cut to the funny farm.

This is the problem which the accompanying program will solve. Looking things up in lists is just what computers are good at, and it will provide a list of op-codes with all the data in the right places, leaving you the opportunity to be creative with the results.

The program was developed on a Nascom 2 using 16K of RAM from 1000 hex to 4FFF hex: it is therefore capable of working on code at any other addresses. If the software to be processed occupies the space mentioned above — no problem. Simply load it to somewhere else, say 5000 hex, and the program asks not only where it is but where it ought to be. All addresses will be suitably adjusted. Lacking psychic powers, the program will be confused by tables of data or character strings and it may give up with a syntax error if presented with illegal instructions, but otherwise will produce an assembler listing.

Nascom users must remember to answer the "Memory size?" question with 20480 to stop greedy old BASIC corrupting memory it doesn't need. People with other Z80 machines must take their own precautions and when undertaking conversion, will find nothing they don't recognise in the program. The only PEEK is to obtain the byte to be worked on and there are no POKEs.

## HOW IT WORKS

Line 60, CLEAR 2500, is required by Nascom BASIC to set aside space for storage of string variables. Lines 70 to 90 dimension arrays in which various values will be stored to avoid reading then each time they are required and thus speed things up. The CLS in line 110 clears the screen.

Lines 100 to 240 are concerned with asking the user for the addresses of the code to be processed. The subroutine called at 3000 converts hex strings to decimal numbers. It requires the hex to be passed in XX$ and its length in LL. The result comes back in XX. Any detectable errors cause a question to be repeated.

The program of disassembly starts at line 1000. The variable P is the decimal address of the byte currently being decoded. At line 1020 the subroutine 2900 is called to convert it to hex, allowing for any offset given during the set-up procedure. The subroutine at 3300 is used to find the op-code corresponding to the byte whose hex value is in B$ unless it is one of CB, ED, DD or FD, when the op-code depends on the following byte. This is detected because the subroutine returns the length of the op-code in LN except in these four cases, when it returns LN=0.

In the op-code finding subroutine at 3300, the purpose of line 3350 is to check whether the subroutine has been called before. If it hasn't, data is read by lines 3360 to 3590. To understand how the subroutine works you need to know something about the Z80 instruction set. Many of the one byte instructions have values from 40 hex (64 decimal) to BF hex (191 decimal) and their mnemonics follow a systematic pattern. Calculations based on this pattern are performed by lines 3620 to 3710. Instructions outside the range mentioned above are less friendly and the program resorts to

looking them up in the table OP$(0-255). The op-code is returned in OP$ and the length of the corresponding instruction in LN (with the four exceptions mentioned earlier).

In line 1040 the byte decoded is tacked onto the address P$ for subsequent output. It is then necessary to take alternative action according to the length returned in LN.

In the case of lengths equal to one there are three exceptional cases peculiar to the NAS-SYS monitor. RST SCAL calls a monitor subroutine specified by the following byte. RML users will recognise this as an 'EMT'. RST PRS is used to output the following string of ASCII characters, terminated by a null. RST RCAL is used to make a call by specifying a one byte offset rather than a two byte address. The output listing shows the absolute address called so you can see what's going on. If none of these exceptions is detected by lines 1190 to 1460, the program jumps to the end of the disassembly loop at 2240: here the subroutine at 2700 is called to output the decoded line. At line 2250 a check is made to see if we have finished and if not, it's back to 1000 to go through the whole process again.

Lines 1100 to 1160 deal with cases where we know the op-code but it refers to data in following bytes. The data will be either a single byte in the case of two byte instructions or two bytes, often an address, in the case of three byte instructions. The op-codes are returned by the 3300 subroutine with a 'V' in the position where the data needs to be inserted. Lines 1110 and sometimes 1150 construct the data as a two or four character string V$. Line 1160 calls the subroutine at 2800 to replace this 'V' with the value of V$ in the case of three byte instructions, but for two byte instructions it is first necessary to check for two exceptions. JR and DJNZ instructions both make relative jumps, and the listing needs to show the address jumped to rather than the offset if it is to be of any use, so lines 1470 to 1520 are first used to change V$ appropriately, making the necessary adjustment for forward and backward jumps and the two byte offset. After making checks for the exceptions, V$ is inserted by the call at line 2230 and the end of the loop reached as before.

It will be seen that the majority of op-codes have been dealt with but that program lines 1540 to 2210 have not been discussed. The codes beginning CB are all two bytes long and deal with the individual bits within a byte. Their mnemonics follow a relatively simple pattern which is implemented by lines 1590 to 1610 after the second byte has been found by line 1580. Lines 1650 to 2000 deal with the ragbag of instructions beginning ED and determined by the byte following the ED. This byte is found by the call in line 1660, then the op-code is arrived at by a combination of calculation and table look-up. Notice that some of these instructions contain data in subsequent bytes which is PEEKed and inserted by the method described above.

In lines 2010 to 2220 the rather easier problem of instructions using the index registers is tackled. All these instructions resemble those using the HL register but have either DD, for the IX register, or FD, for the IY register, on the front. Advantage is taken of this at line 2050, where the 3300 op-code finding subroutine is called. Then the subroutine at 2400 replaces the 'HL' with either 'IX' or 'IY'. It is first necessary to check in line 2100, however, for those instructions which refer to the register plus an offset given by the third of the four bytes. This offset is found and inserted by lines 2110 and 2120.

Finally lines 2150 to 2220 deal with those instructions containing both the DD/FD and the CB problem by a combination of the methods previously described.

The program is structured in well-defined blocks and contains plenty of REMs so you can get most of it to work without having to type those bits dealing with rarely encountered instructions or not relevant to your machine. Lines 2300 to 3720 are essential, as is the data from 4000 to 4710, but after typing them you could get away with only adding lines 10 to 1190. If you leave out the REMs (and who wouldn't) you will need to know that all GOSUBS and GOTOS address the REM at the start of the structure called. Consequently any UL errors can be corrected by inserting the next existing line number.

| VARIABLE | FUNCTION |
|---|---|
| OP$ | (Eventually) contains the current op-code |
| P | Points at the current byte |
| XX$, XX, LL | Passes and returns values to the hex-decimal and decimal-hex subroutines |
| LN | The length of the current instruction, or 0 to indicate an exceptional instruction |
| B$ | The current byte in hex |
| V$ | Any argument to be inserted into an op-code |
| P$ | The current address plus a space plus the bytes of the current instruction. |

```
Answer these questions with 4 disit hex numbers

Where is the code to be processed? D523

Where is the  top of  the    code? D5BE

Where does the code actually  run? D523

D523 22290C          LD (0C29),HL
D526 DDE5            PUSH IX
D528 E1              POP HL
D529 DF              RST SCAL
D52A 66              DEFB 66
D52B DD7E00          LD A,(IX+00)
D52E DF              RST SCAL
D52F 67              DEFB 67
D530 2A290C          LD HL,(0C29)
D533 23              INC HL
D534 DD7E00          LD A,(IX+00)
D537 77              LD (HL),A
D538 23              INC HL
D539 22290C          LD (0C29),HL
D53C C9              RET
D53D 21FFCF          LD HL,CFFF
D540 063F            LD B,3F
D542 70              LD (HL),B
D543 2B              DEC HL
D544 10FC            DJNZ D542
D546 70              LD (HL),B
D547 0640            LD B,40
D549 C5              PUSH BC
D54A 063E            LD B,3E
D54C DD21C0CF        LD IX,CFC0
D550 C5              PUSH BC
D551 B7              OR A
D552 DD7E01          LD A,(IX+01)
D555 CDCFD5          CALL D5CF
D558 E5              PUSH HL
D559 DD7E00          LD A,(IX+00)
D55C CDCFD5          CALL D5CF
D55F D1              POP DE
D560 CDDDD5          CALL D5DD
D563 300E            JR NC D573
D565 DD7E00          LD A,(IX+00)
D568 67              LD H,A
D569 DD7E01          LD A,(IX+01)
D56C DD7700          LD (IX+00),A
D56F 7C              LD A,H
D570 DD7701          LD (IX+01),A
D573 DD23            INC IX
D575 C1              POP BC
D576 10D8            DJNZ D550
D578 C1              POP BC
D579 10CE            DJNZ D549
D57B 063F            LD B,3F
D57D DD21C0CF        LD IX,CFC0
D581 0E14            LD C,14
D583 C5              PUSH BC
D584 DD7E00          LD A,(IX+00)
D587 DD23            INC IX
D589 CDCFD5          CALL D5CF
D58C E5              PUSH HL
D58D FDE1            POP IY
D58F FD7E06          LD A,(IY+06)
D592 FEFF            CP FF
D594 2814            JR Z D5AA
D596 F5              PUSH AF
D597 0606            LD B,06
D599 7E              LD A,(HL)
D59A F7              RST ROUT
D59B 23              INC HL
D59C 10FB            DJNZ D599
D59E 3E20            LD A,20
D5A0 F7              RST ROUT
D5A1 F1              POP AF
D5A2 DF              RST SCAL
D5A3 68              DEFB 68
D5A4 EF              RST PRS
D5A5 202000          DEFM '  '
D5A8 1803            JR D5AD
D5AA C1              POP BC
D5AB 0C              INC C
D5AC C5              PUSH BC
D5AD C1              POP BC
D5AE 0D              DEC C
D5AF C5              PUSH BC
D5B0 79              LD A,C
D5B1 0E04            LD C,04
D5B3 91              SUB C
D5B4 30FD            JR NC D5B3
D5B6 C604            ADD A,04
D5B8 2003            JR NZ D5BD
D5BA 3E0D            LD A,0D
D5BC F7              RST ROUT
D5BD C1              POP BC
D5BE 2007            JR NZ D5C7
End address reached
Ok
```

**Listing 1. The BASIC listing of the Z80 disassembler. An example run is shown at the foot of the previous page.**

```
10 REM ****************************************
20 REM * Dissassembler by J. Parry 21/11/82  *
30 REM * Decodes all Z80  mnemonics and NAS  *
40 REM * SYS restarts with address  offset   *
50 REM ****************************************
60 CLEAR 2500
70 DIM OP$(255),LN(255) :REM Mnemonics+lengths
80 DIM CG$(31)          :REM CB names
90 DIM ED(27),ED$(27)   :REM ED Mnemonics+codes
100 REM *********** Get limits*******************
110 CLS
120 PRINT "Answer these questions with 4 digit";
130 PRINT " hex numbers"
140 PRINT
150 INPUT "Where is the code to be processed";S$
160 XX$=S$:LL=4:GOSUB 3000:P=XX:IF P<0 THEN 150
170 PRINT
180 INPUT "Where is the  top of  the    code";T$
190 XX$=T$:LL=4:GOSUB 3000:T=XX:IF T<0 THEN 180
200 IF T<P THEN 150
210 PRINT
220 INPUT "Where does the code actually  run";V$
230 XX$=V$:LL=4:GOSUB 3000:IF XX<0 THEN 220
240 OF=P-XX:CLS
250 REM
260 REM
1000 REM ***** Control disassembly **********
1010 REM
1020 GOSUB 2900:OP$=""
1030 XX=P:GOSUB 2600:B$=XX$:GOSUB 3300:P=P+1
1040 P$=P$+" "+B$:IF LN=1 THEN 1190
1050 IF LN=0 THEN 1540:REM CB,ED,DD,FD
1060 REM
1070 REM
1100 REM ==Two & Three byte codes ============
1110 GOSUB 2330:V$=XX$
1120 IF LN=2 THEN 1470
1130 REM
1140 REM ==Three byte normal codes ============
1150 GOSUB 2330:V$=XX$+V$
1160 GOSUB 2800:GOTO 2240
1170 REM
1180 REM
1190 REM ===Excertional 1 byte codes ==========
1200 REM
1210 IF B$()"DF" THEN 1270
1220 REM ====== RST SCAL ======================
1230 GOSUB 2700:GOSUB 2900
1240 XX=P:GOSUB 2600
1250 P$=P$+" "+XX$:OP$="DEFB "+XX$
1260 GOSUB 2700:P=P+1:GOTO 2250
1270 IF B$()"EF" THEN 1300
1280 REM
1290 REM ====== RST PRS ======================
1300 GOSUB 2700:GOSUB 2900
1310 P$=P$+" ":OP$="DEFM '"
1320 XX=P:GOSUB 2600:P$=P$+XX$
1330 LL=2:GOSUB 3000:OP$=OP$+CHR$(XX)
1340 IF XX$()"00" THEN P=P+1:GOTO 1320
1350 P$=LEFT$(P$,20):OP$=OP$+"'"
1360 GOSUB 2700:P=P+1:GOTO 2250
1370 REM
1380 REM ====== RST RCAL ======================
1390 IF B$()"D7" THEN 1460
1400 GOSUB 2700:GOSUB 2900:XX=P:GOSUB 2600
1410 P$=P$+" "+XX$:OP$="DEFB "+XX$+"'Calls "
1420 IF QQ>127 THEN QQ=QQ-256
1430 LL=4:XX=P+QQ+1:GOSUB 3100:OP$=OP$+XX$
1440 GOSUB 2700:P=P+1
1450 GOTO 2250
1460 GOTO 2240
1470 REM === Exceptional two byte codes =====
1480 IF LEFT$(OP$,2)="JR" THEN 1510
1490 IF B$="10" THEN 1510
1500 GOTO 2230:REM not JR or DJNZ
1510 IF QQ>127 THEN QQ=QQ-256
1520 XX=P+QQ-OF:LL=4:GOSUB 3100:V$=XX$
1530 GOTO 2230
1540 REM ------ Difficult bits ----------------
1550 IF B$()"CB" THEN 1640
1560 REM === CB codes ========================
1570 REM
1580 GOSUB 2330
1590 OP$=CG$(QQ/8):IF QQ<64 THEN 1610
1600 OP$=OP$+CHR$(ASC("@")+(QQ AND 56)/8)+","
1610 OP$=OP$+RG$(QQ AND 7)
1620 GOTO 2240
1630 REM
1640 IF B$()"ED" THEN 2010
1650 REM ==== ED codes =======================
1660 GOSUB 2330
1670 IF (QQ AND 128)=128 THEN 1970
1680 IF (QQ AND 64)=0 THEN 1970
1690 D=QQ AND 15
1700 IF D<>0 THEN 1730
1710 OP$="IN "+RD$((QQ AND 56)/8)+",(C)"
1720 GOTO 2240
1730 IF D<>1 THEN 1760
1740 OP$="OUT (C),"+RD$((QQ AND 56)/8)
1750 GOTO 2240
1760 IF D<>2 THEN 1790
1770 OP$="SBC HL,"+RP$((QQ AND 48)/16)
1780 GOTO 2240
1790 IF D<>3 THEN 1850
1800 OP$="LD (V),"+RP$((QQ AND 48)/16)
1810 GOSUB 2330:V$=XX$
1820 GOSUB 2330:V$=XX$+V$
1830 GOSUB 2800
1840 GOTO 2230
1850 IF (QQ AND 15)<>10 THEN 1900
1860 D=(QQ AND 48)/16
1870 IF (D)3) OR (D<0) THEN 1970
1880 OP$="ADC HL,"+RP$(D)
1890 GOTO 2240
1900 IF (QQ AND 15)<>11 THEN 1970
1910 D=(QQ AND 48)/16
1920 IF (D)3) OR (D<0) THEN 1970
1930 OP$="LD "+RP$(D)+",(V)"
1940 GOSUB 2330:V$=XX$
1950 GOSUB 2330:V$=XX$+V$
1960 GOTO 2230
1970 REM =====Non Calculable ED's==============
1980 FOR I=1 TO 28
1990 IF QQ=ED(I) THEN OP$=ED$(I):GOTO 2240
2000 NEXT I
2010 REM ===== DD & FD codes ==================
2020 I$="IX":IF B$="FD" THEN I$="IY"
2030 GOSUB 2330:B$=XX$
2040 Q=QQ:IF B$="CB" THEN 2150
2050 GOSUB 3300:GOSUB 2500
2060 IF LN=1 THEN 2100
2070 GOSUB 2330:V$=XX$
2080 IF LN=2 THEN 2100
2090 GOSUB 2330:V$=XX$+V$
2100 IF (Q<52) OR (Q>224) THEN 2230
2110 XX=P:GOSUB 2600:B$=XX$:GOSUB 2400:P=P+1
2120 P$=P$+B$
2130 GOTO 2230
2140 REM
2150 REM ===== DD or FD + CB codes =========
2160 GOSUB 2330:B$=XX$
2170 GOSUB 2330
2180 OP$=CG$(QQ/8):IF QQ<64 THEN 2200
2190 OP$=OP$+CHR$(ASC("@")+(QQ AND 56)/8)+","
2200 OP$=OP$+RG$(QQ AND 7)
2210 GOSUB 2500:GOSUB 2400
2220 GOTO 2230
2230 GOSUB 2800
2240 GOSUB 2700
2250 IF P<=T THEN 1000
2260 PRINT "End address reached":END
2270 REM
2280 REM
2300 REM ======================================
2310 REM ****** Subroutines start here *******
2320 REM
2330 REM ==Peek the byte at P & add the hex===
2340 REM ==of it onto P$ then increment P
2350 XXJP:GOSUB 2600:P$=P$+XX$:P=P+1
2360 RETURN
2370 REM
2400 REM ==Accepts a mnemonic OP$ and byte B$
2410 REM ==Inserts "+B$" in OP$ after "IX" or
2420 REM =="IY"
2430 FOR I=1 TO LEN(OP$)
2440 ZZ$=MID$(OP$,I,2)
2450 IF ZZ$="IX" OR ZZ$="IY" THEN 2470
2460 NEXT I
2470 Z$=LEFT$(OP$,I+1)+"+"+B$
2480 Z$=Z$+MID$(OP$,I+2):OP$=Z$
2490 RETURN
2500 REM ==Accepts OP$,replaces HL with I$====
2510 REM ==which will be "IX" or "IY"
2520 FOR I=1 TO LEN(OP$)
2530 IF MID$(OP$,I,2)="HL" THEN 2550
2540 NEXT I
2550 Z$=LEFT$(OP$,I-1)+I$
2560 Z$=Z$+MID$(OP$,I+2):OP$=Z$
2570 RETURN
2580 REM
2600 REM ==Peeks byte at XX "ko XX$==========
2610 IF XX(32768 THEN QQ=PEEK(XX):GOTO2630
2620 QQ=PEEK(XX-65536)
2630 XX=QQ:LL=2:GOSUB 3100
2640 RETURN
2650 REM
2700 REM ==========Prints output line=========
2710 PRINT $#TAB(22)OP$
2720 RETURN
2730 REM
2800 REM ==Replaces V in OP$ with V$==========
2810 Z$="":FOR I=1 TO LEN(OP$)
2820 ZZ$=MID$(OP$,I,1):IF ZZ$="V" THEN 2840
2830 Z$=Z$+ZZ$:GOTO 2850
2840 Z$=Z$+V$
2850 NEXT I:OP$=Z$
2860 RETURN
2870 REM
2900 REM ==Convert address P to hex===========
2910 REM ==return it in P$
2920 XX=P-OF:LL=4:GOSUB 3100:P$=XX$
2930 RETURN
2940 REM
3000 REM ==Hex to decimal=====================
3010 REM ==Returns value of XX$,length LL in XX
3020 IF LEN(XX$)<>LL THEN XX=-1:RETURN
3030 HH=16^(LL-1):XX=0:SS$="0123456789ABCDEF"
3040 FOR II=1 TO LL
3050 FOR JJ=1 TO 16
3060 IF MID$(XX$,II,1)=MID$(SS$,JJ,1) THEN 3080
3070 NEXT JJ:XX=-1:RETURN
3080 XX=XX+HH*(JJ-1):HH=HH/16
3090 NEXT II:XX=INT(XX+.1):RETURN
3100 REM ==Decimal to hex=====================
3110 REM ==Returns value of XX in XX$
3120 REM ==length required passed in LL
3130 HH=16^(LL-1):XX$=""
3140 FOR II=1 TO LL
3150 NN=XX/HH:XX=HH*(NN-INT(NN)):HH=HH/16
3160 NN=INT(NN)+ASC("0")
3170 IF NN <= ASC("9") THEN 3190
3180 NN=NN+ASC("A")-ASC("9")-1
3190 XX$=XX$+CHR$(NN)
3200 NEXT II
3210 RETURN
3220 REM
3300 REM ==Subroutine accepts byte B$==========
3310 REM ==If its not CB,ED,DD,or FD
3320 REM ==returns in OP$ the opcode
3330 REM ==of B$ with "V" in place of any
3340 REM ==arguments and length in LN
3350 IF OP$(1)<>"" THEN 3590
3360 REM ==Read data the first time called
3370 FOR I=0 TO 7:READ RG$(I):NEXT I
3380 DATA B,C,D,E,H,L,"(HL)",A
3390 FOR I=0 TO 7:READ SG$(I):NEXT I
3400 DATA "ADD A,","ADC A,","SUB ","SBC "
3410 DATA "AND ","XOR ","OR ","CP "
3420 FOR I=0 TO 7:READ CG$(I):NEXT I
3430 DATA "RLC ","RRC ","RL ","RR "
3440 DATA "SLA ","SRA ","?SLL? ","SRL "
3450 FOR I= 8 TO 15:CG$(I)="BIT ":NEXT I
3460 FOR I=16 TO 23:CG$(I)="RES ":NEXT I
3470 FOR I=24 TO 31:CG$(I)="SET ":NEXT I
3480 FOR I=0 TO 3:READ RP$(I):NEXT I
3490 DATA BC,DE,HL,SP
3500 FOR I=0 TO 7:READ RD$(I):NEXT I
3510 DATA B,C,D,E,H,L,*,A
3520 FOR I=0 TO 255
3530 IF (I)63) AND (I<192) THEN 3570
3540 IF I=203 OR I=221 THEN 3570
3550 IF I=237 OR I=253 THEN 3570
3560 READ OP$(I),LN(I):LN=1
3570 NEXT I
3580 FOR I=1 TO 27:READ ED(I),ED$(I):NEXT I
3590 REM === End of data read ================
3600 LL=2:XX$=B$:GOSUB 3000:OP=XX
3610 IF (OP)63) AND (OP<192) THEN 3630
3620 OP$=OP$(OP):LN=LN(OP):GOTO 3720
3630 IF OP=118 THEN OP$="HALT":GOTO 3710
3640 IF OP)127 THEN 3690
3650 OP$="LD "
3660 OP$=OP$+RG$((OP AND 56)/8)+","
3670 OP$=OP$+RG$(OP AND 7)
3680 GOTO 3710
3690 OP$=SG$((OP AND 56)/8)
3700 OP$=OP$+RG$(OP AND 7)
3710 LN=1
3720 RETURN
4000 REM ************************************
4010 REM Each Mnemonic is followed by
4020 REM the length of the corresponding
4030 REM OP code. Mnemonics which take data
4040 REM from followins bytes contain a V
4050 REM at the position at which it will
4060 REM be inserted.
4070 REM CB,ED,DD & FD are not in this list
4080 REM because they are dealt with
4090 REM separately.
4100 DATA "DEFB 00",1,    "LD BC,V",3
4110 DATA "LD (BC),A",1,  "INC BC",1
4120 DATA "INC B",1,      "DEC B",1
4130 DATA "LD B,V",2,     "RLCA",1
4140 DATA "EX AF,AFG",1,  "ADD HL,BC",1
4150 DATA "LD A,(BC)",1,  "DEC BC",1
4160 DATA "INC C",1,      "DEC C",1
4170 DATA "LD C,V",2,     "RRCA",1
4180 DATA "DJNZ V",2,     "LD DE,V",3
4190 DATA "LD (DE),A",1,  "INC DE",1
4200 DATA "INC D",1,      "DEC D",1
4210 DATA "LD D,V",2,     "RLA",1
4220 DATA "JR V",2,       "ADD HL,DE",1
4230 DATA "LD A,(DE)",1,  "DEC DE",1
4240 DATA "INC E",1,      "DEC E",1
4250 DATA "LD E,V",2,     "RRA",1
4260 DATA "JR NZ V",2,    "LD HL,V",3
4270 DATA "LD (V),HL",3,  "INC HL",1
4280 DATA "INC H",1,      "DEC H",1
4290 DATA "LD H,V",2,     "DAA",1
4300 DATA "JR Z V",2,     "ADD HL,HL",1
4310 DATA "LD HL,(V)",3,  "DEC HL",1
4320 DATA "INC L",1,      "DEC L",1
4330 DATA "LD L,V",2,     "CPL",1
4340 DATA "JR NC V",2,    "LD SP,V",3
4350 DATA "LD (V),A",3,   "INC SP",1
4360 DATA "INC (HL)",1,   "DEC (HL)",1
4370 DATA "LD (HL),V",2,  "SCF",1
4380 DATA "JR C V",2,     "ADD HL,SP",1
4390 DATA "LD A,(V)",3,   "DEC SP",1
4400 DATA "INC A",1,      "DEC A",1
4410 DATA "LD A,V",2,     "CCF",1
4420 DATA "RET NZ",1,     "POP BC",1
4430 DATA "JP NZ V",3,    "JP V",3
4440 DATA "CALL NZ V",3,  "PUSH BC",1
4450 DATA "ADD A,V",2,    "RST START",1
4460 DATA "RET Z",1,      "RET",1
4470 DATA "JP Z V",3,     "CALL Z V",3
4480 DATA "CALL V",3,     "ADC A,V",2
4490 DATA "RST RIN",1,    "RET NC",1
4500 DATA "POP DE",1,     "JP NC V",3
4510 DATA "OUT (V),A",2,  "CALL NC V",3
4520 DATA "PUSH DE",1,    "SUB V",2
4530 DATA "RST RCAL",1,   "RET C",1
4540 DATA "EXX",1,        "JP C V",3
4550 DATA "IN A,(V)",2,   "CALL C V",3
4560 DATA "SBC A,V",2,    "RST SCAL",1
4570 DATA "RET PO",1,     "POP HL",1
4580 DATA "JP PO V",3,    "EX (SP),HL",1
4590 DATA "CALL PO V",3,  "PUSH HL",1
4600 DATA "AND V",2,      "RST BRKPT",1
4610 DATA "RET PE",1,     "JP (HL)",1
4620 DATA "JP PE V",3,    "EX DE,HL",1
4630 DATA kALL PE V",3,   "XOR V",2
4640 DATA "RST PRS",1,    "RET P",1
4650 DATA "POP AF",1,     "JP P V",3
4660 DATA "DI",1,         "CALL P V",3
4670 DATA "PUSH AF",1,    "OR V",2
4680 DATA "RST ROUT",1,   "RET M",1
4690 DATA "LD SP,HL",1,   "JP M V",3
4700 DATA "EI",1,         "CALL M V",3
4710 DATA "CP V",2,       "RST RDEL",1
4720 REM ************************************
4730 REM Data for those of the two byte
4740 REM OP codes of the form EB XX which
4750 REM cannot be arrived at by calculation
4760 REM The number is the byte XX in decimal
4770 DATA  68,"NEG",    69,"RETN",    72,"IM 0"
4780 DATA  77,"RETI",   79,"LD R,A",  86,"IM 1"
4790 DATA  87,"LD A,I", 95,"LD A,R",102,"IM 2"
4800 DATA 103,"RRD",   111,"RLD",    160,"LDI"
4810 DATA 161,"LDI",   162,"INI",    163,"OUTI"
4820 DATA 168,"LDD",   169,"CPD",    170,"IND"
4830 DATA 171,"OUTD",  176,"LDIR",   177,"CPIR"
4840 DATA 178,"INIR",  179,"OTIR",   184,"LDDR"
4850 DATA 185,"CPDR",  186,"INDR",   187,"OTDR"
4860 REM ********** The end ******************
Ok
```

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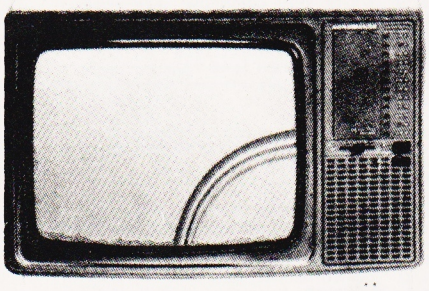

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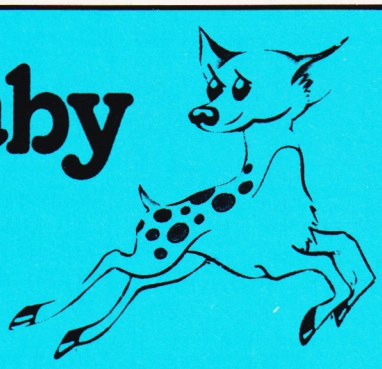

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**Don Thomasson**

# PROBLEM PAGE

**This month we show how to reduce a problem to its solution by reducing it, and set another poser for puzzled programmers.**

Solving last month's problem depends to some extent on specialised knowledge or sudden inspiration, but you were given a useful hint. The equation to be solved was:

```
1386*A + 1092*B + 1001*C +
1716*D = 39742
```

Factorising the constants on the left of the equation, with the aid of the program last month, gives:

```
1386 = 3 * 6 * 7 * 11
1092 = 2 * 6 * 7      * 13
1001 =         7 * 11 * 13
1716 = 2 * 6      * 11 * 13
```

All the constants but one are divisible by 13, so to find A we compute the equation modulo 13. To do this, the equation is rewritten using the following steps:

```
(1378 + 8)*A + 1092*B + 1001*C +
1716*D = 39742

8*A + 1378*A + 1092*B + 1001*C +
1716*D = 39741 + 1

8*A + 13*(106*A + 84*B + 77*C +
132*D) = (13*3057) + 1
```

Each side of the equation has a term divisible by 13, and a remainder. Equating the remainders gives:

```
8*A = 1 mod 13
```

or:

```
8*A = 1 + 13*N
```

The reduced equation tells us that A = (13*N + 1)/8, and a little mental arithmetic will show that the only possible value for A, within the stated 10p limit, is 5, obtained with N=3.

Similar calculations in modulo 11, 7 and 6 will separate the other terms.

The program in Listing 1 will work all this out automatically, though it will not quite provide the complete solution. If your computer has a MOD function, you will not need the function defined in line 3010. All you need is X MOD E, which gives the remainder for an integer division of X by E. Otherwise, the routine should present no special problems.

The five constants having been entered, a FOR loop tries all modulo values between 2 and 25, saving the need to factorise the constants and discover the key values. If more than one of the factors remains non-zero for a given modulus, the remainder of the calculation is skipped. If only one factor is non-zero, the name of the associated variable will be set in A$.

Line 3190 calculates the possible values for the variable, and these are checked for validity by lines 3210 and 3220. If the value is too high, the next modulus is tried, but if the value is non-integral line 3190 is repeated with R incremented.

There may be more than one value for a particular variable. In modulo 2, C*1 = 0, or C = 2*N, which gives 2, 4, 6, 8 and 10 as possible. However, only single values are given for A and B, and one of the two values given for D can soon be ruled out, because it gives no acceptable value for C. The program could have been extended to make this final calculation but it would have been necessary to store all the results in arrays and try all combinations of them, which would have been a complicated procedure. One of the lessons to be learned is when to stop relying on the computer to help you solve a problem.

You might like to try another similar problem, using the same program:

'Four batches of wire are held in stock, the price per yard for each batch being a whole number of pence, and the quantities being:
A: 12 miles 1167 yards
B: 16 miles 1233 yards
C: 14 miles 775 yards
D: 12 miles 1604 yards
The total value is £7758.04: what are the prices per yard?'

The ZX Spectrum will accept such inputs as 12*1760 + 1167, which makes life easier, but for other computers a modified input procedure may be useful.

## BACK TO FRONT

Problems of this kind are created by working backwards, starting with the selection of suitable constants and then working out the total. The difficulty of the problem lies in the need to reverse the process. Computers are willing enough to evaluate an expression and set the result in a variable, but they are not usually designed to work out the value of a variable embedded in an expression which is equated to a constant. A request to calculate B from the relationship 9*B = 54 will be rejected until the equation is recast as B = 54/9.

Bearing that in mind, how would you persuade a computer to deal with the following problem:

'A tube train leaves central London and stops at six stations before reaching the terminus. At the first stop, half the passengers get off and six get on. At the second stop half the passengers get off and five get on. This continues, one passenger less boarding the train at each station, after half the previous passengers have left, until the terminus is reached with five passengers. How many were there

aboard when the train left central London?'

Solutions which involve trying different answers until one fits should not be considered acceptable. That dodges the issue. However, it should be said that the program which will be offered next month is not fully universal, though it does illustrate the necessary principles.

It will be noted that the problems examined in this series have been strictly mathematical, no word problems being considered. This, in a sense, contradicts the idea that a computer is no more than a super-calculator where the numbers are concerned, whereas it has a unique ability to handle text. A partial truth, perhaps, this idea bears thinking about.

Its weakness lies in the fact that any general work on the manipulation of text entails a fairly widespread vocabulary as a working basis. Processing text that has been provided by the user is no problem, but checking the spelling calls for a fairly large dictionary, preferably one which will grow as it learns the literary habits of its user. Given such a dictionary, it might be possible to teach a computer to solve crossword puzzles, but there is no intention of tackling that project in this series!

A partial solution to the problem of handling text is conversion of the words to symbolic form, and this will figure in a future article. It works by reducing the size of the 'dictionary' to manageable proportions. If that is not possible, a word problem is probably incompatible with the capabilities of a computer.

```
3000 CLS
3010 DEF FN K(A,E)=A-E*(INT (A/E))
3020 INPUT "A?";A
3030 INPUT "B?";B
3040 INPUT "C?";C
3050 INPUT "D?";D
3060 INPUT "Total?";T
3070 FOR E=1 TO 25
3080 LET F=FN K(A,E)
3090 IF F<>0 THEN LET A$="A"
3100 LET G=FN K(B,E)
3110 IF G<>0 THEN LET A$="B"
3120 LET H=FN K(C,E)
3130 IF H<>0 THEN LET A$="C"
3140 LET J=FN K(D,E)
3150 IF J<>0 THEN LET A$="D"
3160 IF (F<>0)+(G<>0)+(H<>0)+(J<>0)<>1 THEN GO TO 3250
3170 LET L=FN K(T,E)
3180 LET R=0
3190 LET Q=(L+R*E)/(F+G+H+J)
3200 LET R=R+1
3210 IF Q>12 THEN GO TO 3250
3220 IF Q=0 OR Q<>INT Q THEN GO TO 3190
3230 PRINT A$;" = ";Q
3240 GO TO 3190
3250 NEXT E
3260 STOP
```

**Listing 1. This will print out the possible values of each variable.**


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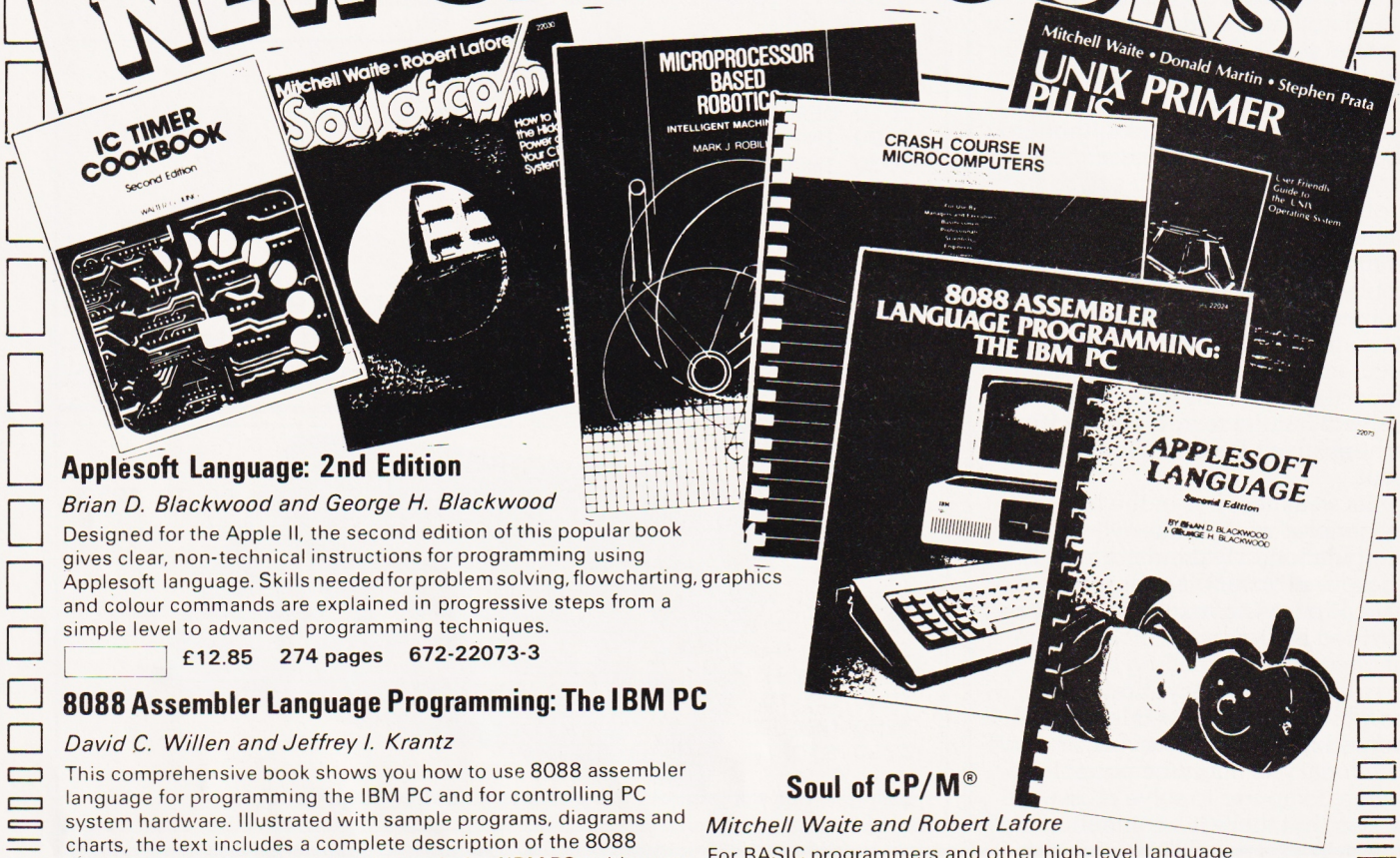


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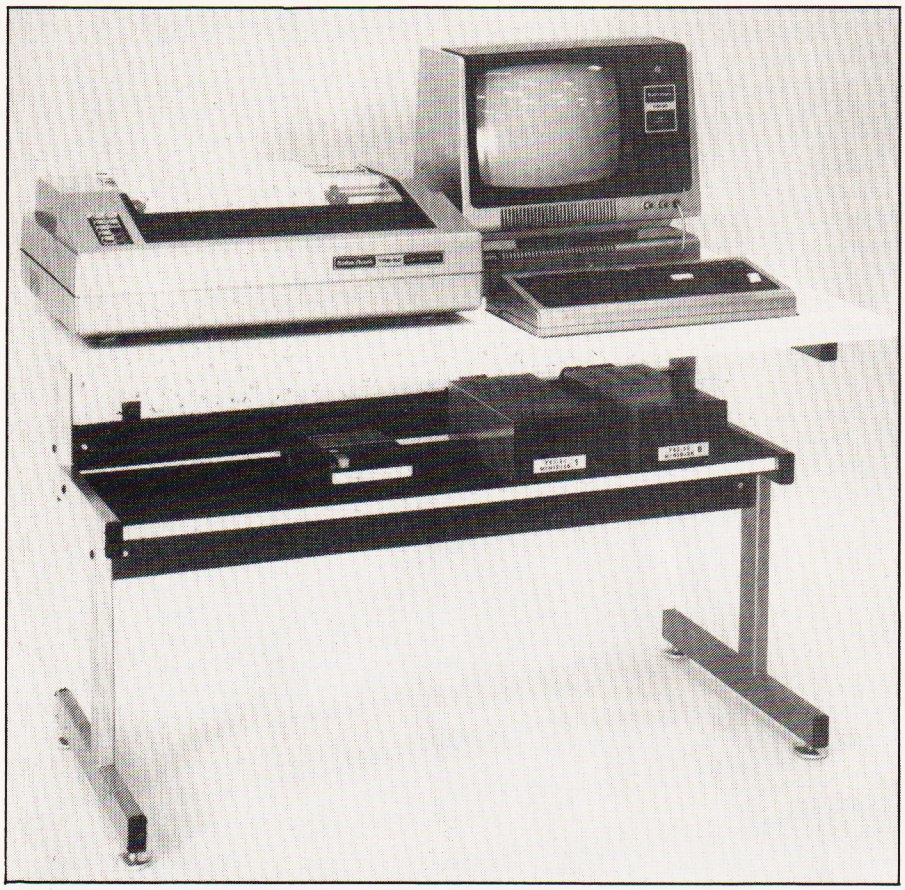
Mark S. Haberfield

# A BETTER TRSDOS

**Tandy's TRSDOS version 2.3 has a number of nasties, not the least of which is that it ignores a large chunk of your disc. Use these patches to get at the phantom tracks.**



Hands up all you TRS-80 or Genie owners who are using 40 or even 80-track minidisc drives under TRSDOS Ver 2.3 and would like to utilise the last five tracks on each diskette for filespace. Here is a painless method of altering the DOS to do this for you.

After using my Genie 1 with dual Olivetti 40-track disc drives under TRSDOS Ver 2.3 for some months, I began to wonder if there was a way of using these five tracks (12.5K) which were being wasted on each diskette. TRSDOS was designed primarily to operate Tandy's own drives, which of course only support the use of 35 tracks per diskette, and does not provide the option of declaring drive parameters to the system as found in some rather more expensive Disk Operating Systems. Consulting H.C. Pennington's **"TRS-80 Disk and Other Mysteries"** led to the discovery that the TRSDOS directory does, however, have space in the GAT (Granule Allocation Table) and TLT (Track Lockout Table) for up to 80 tracks per diskette. Therefore, wringing an extra five tracks out of TRSDOS would more than likely mean some simple modifications to the "/SYS" files responsible for allocation/deallocation of granules to files.

## IN THE BEGINNING

Before these elusive tracks can be used by any DOS, they will require formatting, so the TRSDOS utility program FORMAT/CMD seemed a sensible place to start. The file was dumped, disassembled and after much thought, the resulting assembler source code annotated. Seven loops were found to terminate after processing tracks 0-34 and the positions of the loop counter value tests noted on the file dump.

As the entire source listing was now available, it was also relatively easy to identify the code responsible for two features of the program which had caused some irritation in its use to date. The first of these was minor: I would prefer to use the date in the more conventional DD/MM/YY format that the American format, and as no check is performed on the actual values input the position of the text prompt for the date was noted in the file dump for alteration.

The second annoyance was that, on completion of the formatting process, I felt that the friendly message "HIT 'ENTER' TO CONTINUE" misled the user (me) into thinking that some useful action like a DOS re-entry would be performed when I complied. However, the program merely stopped looking at the 'Enter' key and performed a CPU 'HALT' instruction, leaving me fumbling at the back of the computer for the reset/reboot button; this had to be changed.

The easiest solution to the problem appears to be changing the single byte 'HALT' op-code for a single byte 'RST 00H' op-code by PATCH, and to change the offending message text to "HIT 'ENTER' TO BOOT DOS". This causes the program to wait for 'Enter' to be pressed, and then transfer program execution to memory location zero, which effectively means that the program has pressed the reboot button for you!

A BASIC patch program (PATCHF/BAS) was written to change the loop counters, date format, and program termination of the copy of FORMAT/CMD on disc. Further modified copies are then promulgated by BACKUP, so the patch need only be performed once.

## BACKUP TO THE START

A similar treatment of the TRSDOS utility program BACKUP/CMD uncovered eight loops terminating after processing tracks 0-34 and again some code responsible for the irritating actions of the program. As for the FORMAT utility, the date request and program termination sequence were noted for the same changes.

An extra source of much cursing in the past with this utility has been the message "BACKUP REJECTED, DISKETTES HAVE DIFFERENT PACK IDS!". This occurs when a backup is attempted to a destination disc which does

not have the same diskette name as the source disc. Fair enough I say, I do not understand why Fort Worth put that one in but it is not necessary and it is coming out. The reason for the strong feelings about this one is that some brand new erased destination diskettes cause this fault if the machine is able to get some garbage from the disc background noise, leaving one with a new disc that can't have a copy of DOS put on it by BACKUP. The solution decided upon was to have BACKUP/CMD preformat the disc when Pack ID differences are found, rather than aborting the job.

To complete the modifications to the BACKUP utility, a small change was made in the section of code that decides whether the destination diskette is ready for backup or requires preformatting. The original copy of BACKUP tests track 0 sector 0 for readability to determine this, but this could lead to problems in the 40-track version if a 40-track diskette were backed up onto a 35-track formatted diskette. Therefore the text has been modified to test-read track 39 sector 0 and then decide whether the diskette requires preformatting to prevent this.

The BASIC patch program PATCHB/BAS supplied will make all these alterations to the copy of BACKUP/CMD on disc to save you the trouble of disassembling the code yourselves.

## THE SYSTEM PROGRAMS

**SYS0/SYS** This program contains the code responsible for allocating disc space to a file when filesize requires extending during write operations. Two loops test available granules in the GAT and the positions of the loop counter test values were noted on the file dump. The BASIC patch program PATCHS0/BAS supplied will change these loop counters in the disc file to allow granules to be allocated from the first 40 tracks on the diskette.

**SYS3/SYS** This program contains the code responsible for deallocating granules when a file is deleted. One test is present to test the track number of the granule to be deallocated and this is changed by the supplied BASIC patch program PATCHS3/BAS to allow files that occupy the extra disc space in 40-track systems to be deleted correctly.

**SYS6/SYS** This program contains the code to execute the system library commands such as 'DIR', 'DUMP', 'FREE' etc. In execution of the 'FREE' command, the GAT of each drive's diskette is examined and the unallocated granules are counted in a loop whose exit value is 35. This value is changed to 40 by the supplied BASIC patching program PATCHS6/BAS to allow the 'FREE' command to include unallocated granules on tracks 35-39 in the free granule count.

Another modification implemented by this patch routine is to remove the restriction within 'DUMP' processing that prevents memory locations below 7000H being dumped to disc files. There is really no point in dumping locations 5200H to 7000H because SYS6/SYS loads there to perform the dump, but it is useful to dump the code of feature ROMs to disc files which can then be modified to load and execute as DOS commands.

TRSDOS40 to avoid later confusion and write the sector back into the diskette directory.

Further backup copies of this diskette by the modified BACKUP utility will produce 40-track system diskettes without resorting to patching the directory, because the modified GAT/TLT will be copied to the new diskettes along with the other sector's data.

## IMPLEMENTATION

To safely create the enhanced 40-track TRSDOS system, you will need two new minifloppy diskettes and your master copy of TRSDOS Ver 2.3 (which will, of course, be write-protected in case you make any mistakes). First of all, label the new diskettes so we can refer to them without ambiguity:

## THE FINAL HURDLE

Although the modified FORMAT utility will be capable of producing a data diskette with 77 free granules (three of the total 80 are allocated to the DIR/SYS and BOOT/SYS files), and the modified BACKUP will copy all 40 tracks to a new diskette, we still need a method of creating a diskette with 40 usable tracks that contains a copy of the DOS. This is achieved by backing up a 35-track DOS diskette to a new diskette using the modified BACKUP utility; this will format tracks 35-39 although the GAT and TLT will have these tracks marked allocated/locked out. The supplied BASIC patch program PATCHD/BAS is then used to read the directory GAT sector off this diskette, indicate that granules on tracks 35-39 are free and not locked out, change the diskette name from TRSDOS to

Diskette #1 — 40 TRACK ENHANCED TRSDOS MASTER COPY.
Diskette #2 — 40 TRACK ENHANCED TRSDOS USER COPY.

1. BACKUP your TRSDOS master to Diskette #1 in the normal way. Then return the master TRSDOS diskette to its normal place of safekeeping as it will not be required again for this procedure.
2. Place Diskette #1 in disc drive :0 and boot TRSDOS. Execute BASIC and install the six supplied BASIC patch programs onto the disc:
   PATCHS0/BAS
   PATCHS3/BAS
   PATCHS6/BAS
   PATCHB/BAS
   PATCHD/BAS
   PATCHF/BAS

3. With Diskette #1 in disc drive

**PATCHB/BAS**

```
10 REM
20 REM PATCHB/BAS - PATCH BACKUP/CMD TO FORMAT (IF NECESSARY)
30 REM              A 40 TRACK DISK AND BACKUP TO IT. IF THE
40 REM              DISKETTES HAVE DIFFERENT PACK IDS, THE
50 REM              DESTINATION DISK WILL BE REFORMATTED.
60 REM              AN OPTION TO REBOOT ON COMPLETION WILL BE
70 REM              PROVIDED RATHER THEN "HALT".
80 REM
90 CLEAR 5000
100 PRINT "PATCHING 'BACKUP/CMD' ON DRIVE 0"
110 INPUT "PRESS 'ENTER' TO CONTINUE";0$
120 OPEN "R",1,"BACKUP/CMD.NV36:0"
130 FIELD 1,128 AS A1$, 128 AS A2$
140 GET 1,3
150 T$ = A1$
160 MID$(T$,5,1) = CHR$(&H27)
170 MID$(T$,10,1) = CHR$(&H83)
180 MID$(T$,53,1) = CHR$(&H28)
190 MID$(T$,63,3) = CHR$(&HCD)+CHR$(&H1A)+CHR$(&H44)
200 MID$(T$,75,1) = CHR$(&H28)
210 LSET A1$ = T$
220 PUT 1,3
230 GET 1,4
240 T$ = A1$
250 MID$(T$,78,1) = CHR$(&H28)
260 LSET A1$ = T$
270 PUT 1,4
280 GET 1,5
290 T$ = A1$
300 MID$(T$,3,1) = CHR$(&H28)
310 MID$(T$,19,1) = CHR$(&H28)
320 MID$(T$,30,1) = CHR$(&H28)
330 LSET A1$ = T$
340 PUT 1,5
350 GET 1,6
360 T$ = A1$
370 MID$(T$,1,1) = CHR$(&H28)
380 LSET A1$ = T$
390 T$ = A2$
400 MID$(T$,37,1) = CHR$(&H28)
410 LSET A2$ = T$
420 PUT 1,6
430 GET 1,7
440 T$ = A1$
450 MID$(T$,25,1) = CHR$(&HC7)
460 LSET A1$ = T$
470 PUT 1,7
480 GET 1,10
490 T$ = A1$
500 MID$(T$,115,8) = "BOOT DOS"
510 LSET A1$ = T$
520 PUT 1,10
530 GET 1,11
540 T$ = A1$
550 MID$(T$,35,5) = "DD/MM"
560 LSET A1$ = T$
570 PUT 1,11
580 GET 1,12
590 T$ = A1$
600 MID$(T$,28,15) = "FORMAT REQUIRED"
610 LSET A1$ = T$
620 PUT 1,12
630 PRINT
640 PRINT "THE COPY OF 'BACKUP/CMD' ON DRIVE 0"
650 PRINT "IS NOW CAPABLE OF FORMATTING A DISK"
660 PRINT "USING 40 TRACKS, USING THE DATE IN"
670 PRINT "BRITISH (DD/MM/YY) FORMAT, AND DOING"
680 PRINT "A BACKUP TO THAT DISK. DISKETTE PACK"
690 PRINT "ID DIFFERENCE WILL CAUSE DESTINATION"
700 PRINT "DISK TO BE REFORMATTED.  WHEN BACKUP"
710 PRINT "IS COMPLETED, A REBOOT OPTION WILL"
720 PRINT "BE PROVIDED RATHER THAN SYSTEM 'HALT'."
730 PRINT
740 END
```

**PATCHS0/BAS**

```
10 REM
20 REM PATCHS0/BAS - PATCH "SYS0/SYS" TO USE ALL 40 TRACKS.
30 REM
40 CLEAR 500
50 DEFINT A-Z
60 PRINT "PATCHING 'SYS0/SYS' ON DRIVE 0."
70 INPUT "PRESS 'ENTER' TO CONTINUE.";0$
80 OPEN "R",1,"SYS0/SYS.NV36:0"
90 FIELD 1, 128 AS A1$, 128 AS A2$
100 GET 1,7
110 T$ = A2$
120 MID$(T$,23,1) = CHR$(&H28)
130 MID$(T$,63,1) = CHR$(&H28)
140 LSET A2$ = T$
150 PUT 1,7
160 CLOSE 1
170 PRINT "'SYS0/SYS' PATCHED TO USE 40 TRACKS."
180 END
```

**PATCHS3/BAS**

```
10 REM
20 REM PATCHS0/BAS - PATCH "SYS3/SYS" TO USE ALL 40 TRACKS.
30 REM
40 CLEAR 500
50 DEFINT A-Z
60 PRINT "PATCHING 'SYS3/SYS' ON DRIVE 0."
70 INPUT "PRESS 'ENTER' TO CONTINUE.";0$
80 OPEN "R",1,"SYS3/SYS.NV36:0"
90 FIELD 1, 128 AS A1$, 128 AS A2$
100 GET 1,1
110 T$ = A1$
120 MID$(T$,86,1) = CHR$(&H28)
130 LSET A1$ = T$
140 PUT 1,1
150 CLOSE 1
160 PRINT "'SYS3/SYS' PATCHED TO USE 40 TRACKS."
170 END
```

**PATCHS6/BAS**

```
10 REM
20 REM PATCHS6/BAS - PATCH "SYS6/SYS" TO USE ALL 40 TRACKS AND
30 REM               TO ALLOW 'DUMP' ACCESS TO ALL MEMORY.
40 CLEAR 500
50 DEFINT A-Z
60 PRINT "PATCHING 'SYS6/SYS' ON DRIVE 0."
70 INPUT "PRESS 'ENTER' TO CONTINUE.";0$
80 OPEN "R",1,"SYS6/SYS.NV36:0"
90 FIELD 1, 128 AS A1$, 128 AS A2$
100 GET 1,9
110 T$ = A1$
120 MID$(T$,10,5) = "DD/MM"
130 MID$(T$,126,1) = CHR$(&H28)
140 LSET A1$ = T$
150 T$ = A2$
160 MID$(T$,98,5) = "DD/MM"
170 LSET A2$ = T$
180 PUT 1,9
190 GET 1,12
200 T$ = A2$
210 MID$(T$,69,2) = CHR$(0)+CHR$(0) :REM ENABLE DUMP < 7000
220 LSET A2$ = T$
230 PUT 1,12
240 CLOSE 1
250 PRINT "'SYS6/SYS' PATCHED TO USE 40 TRACKS AND TO"
260 PRINT "ALLOW DUMP OF MEMORY BELOW X'7000'."
270 END
```

:0, containing the patching programs, execute BASIC and type:

RUN"PATCHB/BAS:0"
<enter>

to patch the BACKUP/CMD utility on Diskette #1.

4. Return to DOS command level using:

CMD"S"  <enter>

and use the newly-modified BACKUP utility to backup Diskette #1 to Diskette #2 in the normal way. Note, however, that the date is requested in the civilised (DD/MM/YY) format. The BACKUP program will format Diskette #2 up to and including track 39 but the last track to be copied across will be 34 or less. This is because the program only copies up to and including the highest track number which is marked as allocated to a file in the source diskette's GAT. When program execution is complete and you are requested to press 'enter', TRSDOS will be rebooted on this action without resorting to the reset button.

5. Put Diskette #1 aside for now and place Diskette #2 in drive :0. Execute BASIC and run the remaining five patch programs:

RUN"PATCHS0/BAS:0" <enter>
RUN"PATCHS3/BAS:0" <enter>
RUN"PATCHS6/BAS:0" <enter>
RUN"PATCHF/BAS:0" <enter>
RUN"PATCHD/BAS:0" <enter>

6. Reboot the DOS from Diskette #2 for two reasons: firstly because

### PATCHF/BAS

```
10 REM
20 REM PATCHF/BAS - PATCH FORMAT/CMD TO FORMAT A 40 TRACK DISK
30 REM              AND TO REBOOT AT END INSTEAD OF HALTING.
40 REM
50 CLEAR 5000
60 PRINT "PATCHING 'FORMAT/CMD' ON DRIVE 0"
70 INPUT "PRESS 'ENTER' TO CONTINUE";0$
80 OPEN "R",1,"FORMAT/CMD.NV36:0"
90 FIELD 1,128 AS A1$, 128 AS A2$
100 GET 1,2
110 T$ = A2$
120 MID$(T$,103,1) = CHR$((&H28))
130 LSET A2$ = T$
140 PUT 1,2
150 GET 1,3
160 T$ = A1$
170 MID$(T$,44,1) = CHR$((&H28))
180 MID$(T$,49,1) = CHR$((&H28))
190 LSET A1$ = T$
200 PUT 1,3
210 GET 1,4
220 T$ = A1$
230 MID$(T$,3,1) = CHR$((&H28))
240 LSET A1$ = T$
250 T$ = A2$
260 MID$(T$,78,1) = CHR$((&H28))
270 LSET A2$ = T$
280 PUT 1,4
290 GET 1,5
300 T$ = A2$
310 MID$(T$,4,1) = CHR$((&H28))
320 MID$(T$,15,1) = CHR$((&H28))
330 LSET A2$ = T$
340 PUT 1,5
350 GET 1,6
360 T$ = A2$
370 MID$(T$,4,1) = CHR$((&HC7))
380 LSET A2$ = T$
390 PUT 1,6
400 GET 1,8
410 T$ = A1$
420 MID$(T$,27,5) = "DD/MM"
430 LSET A1$ = T$
440 PUT 1,8
450 GET 1,9
460 T$ = A1$
470 MID$(T$,49,1) = "9"
480 LSET A1$ = T$
490 PUT 1,9
500 GET 1,11
510 T$ = A1$
520 MID$(T$,111,8) = "BOOT D"
530 LSET A1$ = T$
540 PUT 1,11
550 CLOSE 1
560 PRINT
570 PRINT "THE COPY OF 'FORMAT/CMD' ON DRIVE 0"
580 PRINT "IS NOW CAPABLE OF FORMATTING A DISK"
590 PRINT "USING 40 TRACKS, USING THE DATE IN"
600 PRINT "BRITISH (DD/MM/YY) FORMAT, AND WHEN"
610 PRINT "FINISHED - PROVIDING A REBOOT OPTION"
620 PRINT "RATHER THAN A SYSTEM 'HALT'."
630 END
```

### PATCHD/BAS

```
10 REM
20 REM PATCHD/BAS - PATCHES THE DIRECTORY OF FIRST 40 TRACK
30 REM              DISKETTE TO RELEASE GRANULES 76-80 FOR
40 REM              USE BY PATCHED DOS.
50 REM
60 PRINT "PATCHING DIRECTORY ON TRACK 17 OF DRIVE 0"
70 INPUT "PRESS 'ENTER' TO CONTINUE";0$
80 REM *  SET MEMORY TOP TO $AFFF TO PROTECT M/C S/R +
BUFFER
90 POKE 16561,(&HFF) : POKE 16562,(&HAF) : CLEAR 500
100 GOSUB 360 : REM  SET UP M/C SUBROUTINES
110 DEF USR1 = (&HB000)
120 DEF USR2 = (&HB000) + 29
130 GOSUB 280 : REM SELECT DRIVE 0 AND SEEK T17 / S0
140 X = USR1(256) : REM ** READ TRACK 17, SECTOR 0
150 FOR I=(&HB123) TO (&HB127)
160 POKE I,(&HFC)
170 NEXT I
180 FOR I = (&HB183) TO (&HB187)
190 POKE I,(&HFC)
200 NEXT I
210 REM  CHANGE DISKETTE NAME TO TRSDOS40
220 POKE (&HB1D6),52 : POKE (&HB1D7),48
230 GOSUB 280 : REM SELECT DRIVE 0 AND SEEK T17 / S0
240 X = USR2(256) : REM ** WRITE TRACK 17, SECTOR 0
250 PRINT "DIRECTORY ON DRIVE 0 IS PATCHED TO ALLOW USE"
260 PRINT "OF TRACKS  35 - 39."
270 END
280 POKE 14305,1 : REM   SELECT DRIVE AND START MOTOR.
290 POKE 14319,17: REM   LOAD FDC DATA REGISTER WITH
TRACK NO.
300 POKE 14318,0 : REM   LOAD FDC SECTOR REGISTER.
310 POKE 14316,27: REM   ISSUE SEEK (NO VERIFY) COMMAND
TO FDC.
320 ST = PEEK(14316) : REM  GET FDC STATUS WORD.
330 ST = ST AND 1
340 IF ST=1 THEN 320 : REM  IF SEEK NOT COMPLETE - WAIT.
350 RETURN
360 CNT = (&HB000)
370 FOR LO = CNT TO CNT+57
380 READ MC
390 POKE LO,MC
400 NEXT LO
410 RETURN
420 REM
430 REM   ** DATA FOR USR1 M/C SECTOR READ ROUTINE **
440 DATA 243,33,0,177,62,140,50,236,55,6,6,16,254,58,
236,55,203,79,40,249,58,239 ,55,119,35,16,242,251,201
450 REM
460 REM   ** DATA FOR USR2 M/C SECTOR WRITE ROUTINE **
470 DATA 243,33,0,177,62,173,50,236,55,6,8,16,254,58,
236,55,203,79,40,249,126,50 ,239,55,35,16,242,251,201
480 END
```

PATCHD/BAS lowered the pointer to the top of memory to protect its machine code subroutines and sector in/out buffer, and also to ensure that the modified /SYS files are reloaded when required. Request a directory listing of Diskette #2 showing all files with file allocation:

DIR :0 (A,S,I,P)  <enter>

and manually add together the file sizes of all files displayed. Next, request a free space analysis:

FREE  <enter>

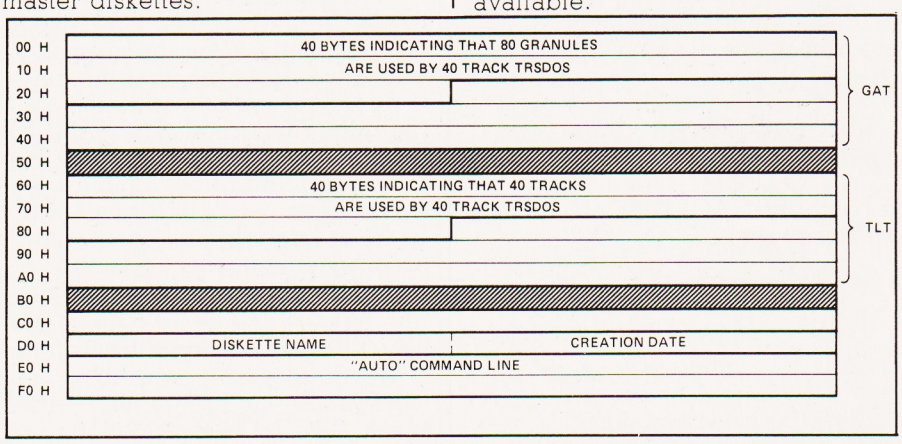
and note the number of free granules on the diskette. You will find that:

<total filespace> + <free space> = 80 Granules.

7. Using the modified BACKUP utility on Diskette #2, backup Diskette #2 to Diskette #1. Both Diskettes now contain the finished 40-track TRSDOS system so it is recommended that Diskette #1 be stored safely with your other master diskettes.

## THE PROOF OF THE PUDDING

Now, ensuring that Diskette #2 is in drive :0, use the 'DUMP' command to create a file that is slightly smaller than free space available:



```
DUMP RUBBISH/CIM:0
(START=X'3000',END=X' <3000
+ (free-1 * 256)> ')
```

Repeat the DIR and FREE operations to show that most of the extra available disc space has been allocated to the new file. Delete the new file:

```
KILL RUBBISH/CIM:0   <enter>
```

and use DIR and FREE to show that the extra granules have been correctly deallocated, once again releasing the extra filespace for use.

The extra filespace is also available to BASIC and the limitation of data files to 335 records (83.75K) is now increased by approximately 15% to 385 records (96.25K). A data base file on a data (no system) diskette may therefore be 50 records larger than previously allowed. All files saved under BASIC on the modified TRSDOS may now be up to 96.25K (98,560 bytes) long on a data diskette.

Once satisfied, you may backup Diskette #2 to other discs, delete the unwanted patch programs and other utilities from these other discs, and put them to good use. I find the larger disc space particularly useful for the Tandy/Microsoft Fortran-80 system, which is originally supplied on two 35-track DOS diskettes. All four files of this package will fit onto one 40-track DOS diskette with room for BACKUP and FORMAT utilities too, eliminating the need to change diskettes between compilation and linking of a FORTRAN program.

## A FINAL WORD

The BASIC patch programs supplied to modify your existing TRSDOS Ver 2.3 into a 40-track DOS are quite straightforward. All except PATCHD/BAS use a system match-all password (courtesy of **TRS-80 Disk and other Mysteries**) to enable simple random access input/output on the protected files. Patching of the directory is achieved by USR machine code subroutines which read and write the GAT sector as an absolute sector on disc (track 17, sector 0). This is necessary because the DOS — quite rightly — denies access to the BOOT and DIR files under all circumstances (the directory track is formatted with a different data field identifier to other tracks to achieve this).

The patches were written to create a 40-track DOS as this was my requirement, but an 80-track DOS system can be created by modifying the Patch programs as follows:

```
PATCHD/BAS

150 FOR I=(&HB123) TO (&HB14F)
180 FOR I=(&HB183) TO (&HB1AF)
220 POKE (&HB1D6),56 : POKE
(&HB1D7),48
```

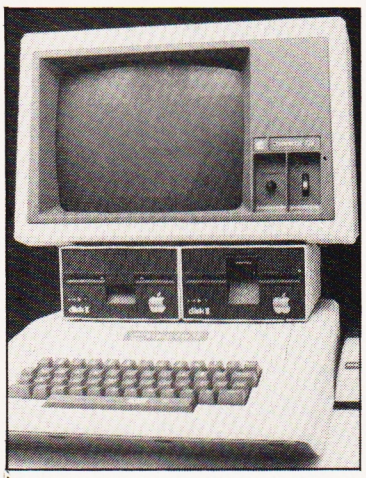
```
PATCHF/BAS

470 MID$(T$,48,2)="79"
```

In all patches, change "(&H28)" references to "(&H50)".

In either case, the modified DOS is upward-compatible with the original TRSDOS: that is, the modified DOS will manipulate 35-track diskettes prepared by the original DOS. However, problems will be encountered if the original DOS is used to attempt deletion of files which occupy the extra space on a 40-track diskette. It is therefore best to only use one format of disc on line at any time, but mixed formats may be used safely if a modified DOS diskette is in drive :0.


*APPLE * APPLE * APPLE * APPLE * APPLE * APPLE * APPLE *



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Wendy J. Palmer

# CLUB CALL

## Read on to find user groups and clubs in your area.

**BELGIAN USER GROUP FOR SINCLAIR COMPUTERS**
Strijdhoflaan 12
2600 Bercham/Antwerp
Belgium
Tel: 010-32 3/449 44 45
(after 7.00 pm)

This Belgian group (BUGS) is a subgroup of the Hobby Computer Club. It is a non-profit organisation purely run by and for amateurs. A monthly magazine HCC-Newsletter is published. The Sinclair group meets every first Saturday at 1.00 pm and every Tuesday at 7.00 pm at the above address. In Leuven and Ghent a group will be started and for more information you 'phone the above number. Other amateurs who haven't got a Sinclair computer can also find a user group in their area. For more general information you should call HCC on 010-32-3/646 89 61 at any time of day. Meetings are held in Antwerp, Hasselt, Ghent, Brussels, Kortrijk, Leuven and the Westkust. Membership is 600Fr a year (about £9) for which you get the magazine. In the club BASIC lessons are given and there is a library with books about microcomputing. Everyone is welcome so if you're in the area why not go along for a visit.

**INTERNATIONAL MZ-80HK**
c/o GPO Box 7849
Hong Kong
Contact: David Roberts

This is a recently formed Hong Kong based user group and is now inviting Sharp MZ-80B users around the world to exchange information. The group caters for MZ-80B users and already has local members using CP/M, experimenting with colour graphics, serial communications with other computers, etc. While there is at present no newsletter or subscription, a newsletter is in the pipeline for the future.

**NORTH LONDON BBC MICRO USERS GROUP**
Department of Chemistry
Westfield College
University of London
Kidderpore Avenue
London NW3 7ST
Contact: Dr Leo M. McLaughlin
Tel: 01-435 0109

This is a relatively new group, still very much in the formation stages. Nevertheless they are university based and do have some access to a wide range of skills and expertise. At present they meet informally at The Prince of Wales, 37 Fortune Green Road, at 7.00 pm on Tuesdays, although at a later date they hope to meet in Westfield College. The group also hopes to build up a software library and bring together as much expertise on the BBC Micro as possible.

**BEEBNET**
PO Box 262
Kingswood
South Australia 5062
Australia

The Australian BBC and Econet Users Group (Beebnet) has only recently been formed and initial local response has been very encouraging. They intend to produce a newsletter on a monthly basis with hints, software evaluation and other items of interest to BBC owners. At this stage they are looking for new members to expand their range of experience in the group. Also they would be interested in any software producers or distributors who would be interested in serving their market requirements.

**IVER COMPUTER SOCIETY**
141 Leas Drive
Iver
Buckinghamshire SL0 9RP
Contact: John Haigh
Tel: 0753-654431

The Society (the IC's) is a new group that powered up on May 12 at the Huntsmoor Room in the Iver Village Hall with a switch on time of 7.30 till 10.00 pm. The meetings are bi-monthly from then on the second and fourth Thursdays and anyone interested should go along to a meeting or contact John. The club will cater for all types of home micros and will be informal in format; it is hoped to cater for all levels of enthusiast from those just about to start to those already bitten by the bug.

**FOLKLIFE TERMINAL CLUB**
Box 2222
Mount Vernon
NY 10551
USA

The Folklife Terminal Club, a Commodore users group, has announced that they are making their software library available to other users of Commodore equipment. The club's archives contain more than 5000 public domain programs in the areas of education, business, games, utilities and more than 25 other categories. The programs are stored on diskettes and are usable on various configurations of PET, CBM and VIC-20 computers. The software itself is free with a copying and mailing fee of US $10 or £7 per diskette, the first one being a catalogue disc.

**SPENNYMOOR AMATEUR COMPUTER CLUB**
126 Mayfields
Spennymoor
County Durham DL16 6TT
Contact: Anthony Vincent
Tel. 0388-817304

The Spennymoor group meets every Thursday evening from 6.30 to 9.30 pm at Spennymoor Recreation Centre. The machines include VIC-20s, ZX Spectrums, ZX81s, Acorn ATOMs, UK 101s, BBC Micros, Colour Genie and an Atari 400. The subscriptions are 20p per meeting and new members (plus micros) are always welcome.

**THE ZX CLUB**
Flat 3
Weighbridge House,
Lapollat,
St. Peter Port
Guernsey
Contact: John Lloyd
Tel: 0481-22769

On the 22nd of March John Lloyd was interviewed on Radio Guernsey and although it was only a five minute interview he has received a lot of response and has thus decided to start a club for ZX users. The first meeting of the group took place in April and it is assumed that meetings will occur monthly. The meetings will be held at the Old Government House

Hotel, St. Annes Place, St. Peter Port, Guernsey (telephone 0481-24921). Open to beginners and experts alike, if you own or use a ZX micro, why not get in contact with John?

**BYTE HOME COMPUTER CLUB**
7 Riverway,
Nailsea,
Avon BS19 1HZ
Contact: V. R. Boyde-Shaw
Tel: Nailsea 851337

This multi-user home computer club has recently been formed for the whole of South Avon district. The annual subscription is £7.50 and the club has a bi-monthly magazine, regular meetings in Nailsea and elsewhere in South Avon as necessary, extra computer workshop meetings, a full advice and information service from a panel of experts and discounted software where available. The first meeting was held in April; why not give Valerie, the Secretary, a ring on the above number.

**THURNSCOE & DISTRICT MICRO CLUB**
62 Tudor Street
Thrunscoe East
Near Rotherham
South Yorkshire S63 0DS
Contact: Peter James Davis (Secretary)
Tel: 0709-893880

This is a newly formed club which had its first meeting on Wednesday March 9, when 70 people were interested. Although not all of these were micro users, a fair range of micros were represented (ZX81, ZX Spectrum, TRS-80, BBC, Dragon 32, NASCOM 3 and VIC-20). A small committee was elected with, for the moment, a Chairman and Secretary. Anyone wishing to join should either go to a meeting or contact the Secretary. The meetings are held on Wednesdays at 7.30 pm at Thurnscoe Comprehensive School, Clayton Lane, Thurnscoe.

**HULL AND DISTRICT TRS-80/ BEEB USERS GROUP**
25 Carr Lane
Willerby
Hull HU10 6JP
Contact: R. V. Souter (Secretary)
Tel: 0482-654117

This group caters obviously for users of Tandy TRS-80 and BBC Microcomputers although other micro owners are welcome. Meetings take place at the Psychology Department at the University at 8.00 pm twice monthly: on the second Tuesday of the month and the Thursday 16 days later. The format of the meetings is that the Tuesday meeting involves a talk or demonstration on either hardware or software followed by a discussion and the Thursday meeting is 'free' for members to pursue their own particular interests. Anyone who wants to know more should either contact the Secretary or the Chairman, J Lawrence, at 2A Hall Road, Hull HU6 8SA, or 'phone 0482-493856.

**THE SCOTTISH DRAGON CLUB**
Top Flat
1 Walker Street
Edinburgh EH3 7JY
Contact: D. J. Anderson

As you might expect this club is for Dragon 32 users with a current membership of 517 from all over the country. The group has obtained discounts for their members from seven different software/hardware manufacturers. A regular newsletter is produced, and membership costs £8.00 which includes a membership card and a free games tape.

**ELMBRIDGE COMPUTER CLUB**
87 Green Lane,
Hersham,
Walton-on-Thames,
Surrey
Contact: Bob Smith or Dave Cackett
Tel: 98-29204 (Bob Smith) or 98-29194 (Dave Cackett after 6.00 pm)

Although only recently formed this club already has over 40 members, many with their own machines, but for those without machines the club has six Newbrain model A computers and a TRS-80 system with printer and discs available for use. There is a library system in operation for loaning books, magazines and hopefully programs in the future. Some members are electronics experts capable of repairing machines and applications groups are being set up to generally discuss particular problems. Membership costs £10.00 per year and although there are no age restrictions, children under 14 should be entrusted to the care of a responsible person. Meetings are held at Elmgrove Meeting Rooms, behind the Magistrates Court in Hersham Road, Walton-on-Thames on every Saturday afternoon from 3.00 pm to 6.00 pm.

**ZX CLUB**
PO Box 3253,
Madrid,
Spain
Contact: Mr C. Benito

This is claimed to be the best ZX users' club in Spain: they edit a monthly newsletter, each of 30-40 pages and teach free BASIC courses each week. The group meets every day from 6.00 pm to 7.30 pm when free interchange of programs takes place.

**xFORTH USERS' GROUP**
2 Gorleston Road,
Poole,
Dorset BH12 1NW
Contact: David Husband
Tel: 0202-764724
This is a club for FORTH users, in particular xFORTH from AIM Research and nas-FORTH, who are interested in extending their knowledge of this interesting language and exchanging information. A variety of machines are covered including Commodore PET, Superbrain, Osborne, NASCOM 2, North Star Horizon, Big-Board, Commodore 64, Dragon 32, Superboard, BBC with Torch Z80 box, etc. Some members of the group are poly-FORTH users (the ultimate FORTH, multi-terminal, multitasking). Meetings will probably be held in Poole when a venue has been arranged. Members who are radio amateurs are able to exchange news etc over a weekly radio net. The subscription is £7.50 per year and a newsletter is produced quarterly.

**HARPENDEN MICROCOMPUTER GROUP**
7 Tylers,
Harpenden,
Hertfordshire AL5 5RT
Contact: R. S. Welch
Tel: 05827-3398

This group caters for many types of personal microcomputer and meets fortnightly on Monday evenings. A newsletter is published and the membership charge is £2.50 per year.

If you would like to have your club mentioned on these pages just send me the details to:

**Club Call,**
**Computing Today,**
**145 Charing Cross Road,**
**London WC2H 0EE.**

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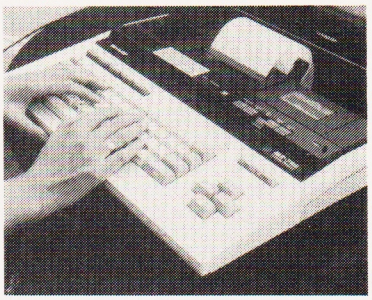

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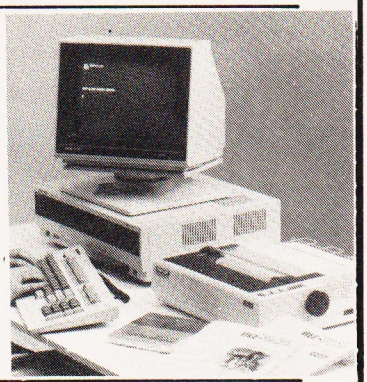

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# PRINTOUT

**Dear Sir,**

*In response to the letter appearing in the August issue written by Mr E. H. Wilson, reference the 48K Oric-1.*

*May I first agree with him as to the quality and comprehensive nature of the Oric-1 computer (having been previously a disappointed owner of a Spectrum — thank you Smiths for your understanding and thank you Oric-1 for your TV tuning controls).*

*I am a little surprised however at his difficulty in plotting numeric variables onto his TV screen. If one accepts that Oric uses a different BASIC set then, despite the user manual, a solution can be quickly found that allows any numeric variable to be plotted in any colour at any location on the screen.*

*What is required first, is the conversion of the number into a string but preferably without the creation of a new string variable ie the number must be converted and plotted in a single line statement.*

*As an example let us use the value π and for the sake of the exercise rationalise it to 3.142. Now consider the following program lines:*

```
100 P=3.142
110 PLOT 10,10,CHR$(3)+RIGHT$((STR$(P+10)),6)
```

*This will produce at the location 10,10 the string 03.142 in the colour yellow. Where the likely length of a numeric variable is always known, eg during games where a score advances by regular amounts, there is no problem with this technique.*

*Where, however, the variable is likely to be set to the result of a mathematical calculation routine then a slightly different approach is more useful.*

*Let us consider π again and the following program lines:*

```
100 P=3.142
110 PLOT 10,10,CHR$(3)+MID$((STR$(P+1000)),3,5)
```

*This will return at location 10,10 the string 03.14, again in yellow, but note that this time the value of π has been 'reduced' to two decimal places (without any rounding up or down having taken place).*

*As long as P does not reach the value 100 then line 110 is quite acceptable. To plot on screen a numeric that may vary in value, say from 1000 to 0.001 then line 110 would be re-written as:*

```
110 PLOT 10,10,CHR$(3)+MID$((STR$(P+10000)),2,8)
```

*With P at 3.14159 the plot on screen would look like this:*
*0003.145*
*The value 892.6 for P would look like:*
*0892.600*
*Note that in all cases:*
*1) Any colour can be used, from the eight available, to plot the numeric (very useful in games)*
*2) Leading zeros are included (very useful in presenting bulk data for review)*
*3) Decimal points always stay in the same place (steady games scores etc and good columnation)*
*4) Leading numbers of numeric values beyond the field size can be lost (choose length of string in line 110 carefully) although this can be an advantage if you can push your 'invaders' score beyond normal human limits.*

*If you wish the numeric variable to be used several times during a program as a plot on the screen then creation of a string variable, as follows, is one solution:*

```
80 P$=MID$((STR$(P+10000)),2,8)
110 PLOT 10,10,CHR$(3)+P$
200 PLOT 10,15,CHR$(6)+P$
        etc
```

*I hope that this may make life a little easier for Oric-1 users and reduce the amount of annotation to the manual, necessary to convert it into a working tool.*

*Yours faithfully,*
*Ian Hall-Dixon,*
*Lancashire.*

*PS To remove that nuisance of a word "CAPS" from the top right of the screen use: POKE 48036,0.*

**Dear Sir,**

*For an anthology, I should welcome contributions of humor in the sciences, historic and contemporary, especially computer-related science. The ordinary man's disquiet about computers has sometimes been expressed in contrived jokes which bring the resented superiority of the expert down to earth. How are jokes changing with the spread of personal minicomputers?*

*I should welcome anecdotes, biographical notes, witty accounts, cartoons, parodies, verse, self-deception and hoaxes. Especially sought are items which, while humorous, also have value in the history of a science, providing insight into changing attitudes or illuminating personalities. Please identify fully the sources of contributions.*

*Yours faithfully,*
*Robert L. Weber,*
*104 Davey Laboratory,*
*University Park,*
*PA 16802, USA*

**Dear Sir,**

*I read with interest your "Special Report #" in the July issue concerning typewriters that can be interfaced to a micro.*

*I would like to bring to your notice the fact that we have been suppling BROTHER EP20 Typewriters with an added RS232 interface for some time.*

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*Prompted by your article, we have decided to extend the availability of our interface and as can be seen from the "ADD ON'S" section of this magazine, we now offer to convert existing EP20s to full RS232 for a nominal sum.*

*Thanks again for an interesting article.*

*Yours faithfully,*
*J Siddle,*
*Aphrodite Electronics Ltd,*
*Stoke-on-Trent.*

(*Should any readers be in a do-it-yourself mood, our sister magazine Electronics Today International is publishing an interface board design in its October issue that will allow computers to use a Silver Reed typewriter as a cheap daisy-wheel printer. This should be on sale by the time you read this*)

**Dear Sir,**

*In your article about Planetfall (CT August 1983) we read that the game is "set a century in the future" and that it "starts on 1 January 2070". Could this be connected with Einstein's theory of Time Dilation at high speeds?*

*Your faithfully,*
*Iain David Stewart,*
*Alva,*
*Scotland.*

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# MICRODIARY

## CHILTERN COMPUTER FAIR

The CHILTERN COMPUTER FAIR will be held on 22 October 1983 at the Challney Community College, Stoneygate Road, Luton, Beds.

The Fair will be the first in this region. There will be 100 exhibiting companies covering all aspects of home, educational and business computers. The site is adjacent to the M1 junction 11.

Exhibitor enquiries are welcome and should be directed to the organiser, Mr John Pinney on Luton (0582) 56400 or 508616.

## MICROCOMPUTER SHORT COURSES

The Polytechnic of the South Bank are holding short courses on the following: Introduction to CP/M on October 6, Microcomputer Appreciation on September 22, BASIC Programming on October 20, Word Processing on November 17, VisiCalc/SuperCalc on November 3 and Record Handling/Management on December 1. All are one-day courses and run from 9.30 am to 4.45 pm in Room 222 of their London Road building (Bakerloo exit at the Elephant & Castle tube). The cost is £55 per person and includes refreshments during the day.

Cancellation clauses are: from one to two weeks, 50% of the course fee, and less than eight days, 100% of the course fee. For more information contact the Local Government Management Training Unit, Polytechnic of the South Bank, London Road, London SE1 0AA.

## INFORMATION MANAGEMENT EXPOSITION & CONFERENCE

Personal business computers, whose use in business applications is growing with extraordinary speed, will be added to those aspects of information management which will receive intensive and specialized attention at the sessions of the 10th annual Information Management Exposition & Conference: INFO 83, the show management has announced.

In all, there will be 14 specialized groups of sessions when INFO 83 convenes at the New York Coliseum, October 10-13. The conferenece is the largest in the information management and computer field to be held anywhere in the world.

The 14 groups of sessions include: Personal Business Computers, Strategies for Information Management, Decision Support Systems, Applications Development, Information Centres, Data Bases, Data Communications, Organization, Implementation, Office Automation, Manufacturing Systems, Law Office Automation, Electronic Publishing and Financial Systems.

The exposition will break its 10-year record for both the number of companies participating as exhibitors and the size of the exhibit area. The show will occupy all available space in the four floors of the Coliseum, the management reported. The Software Centre, which last year proved so successful, will be expanded by 60% this year. No further expansion of the floor plan is possible.

Visitor information, including a full conference program, reduced rate discount tickets and hotel information may be obtained from Show Management, Information Management Exposition & Conference, 708 Third Avenue, New York, NY 10017, USA. Phone (212) 370-1100.

## THE INTERNATIONAL BUSINESS SHOW (IBS '83)

The Institute of Directors is organising a one day conference in association with IBS '83 entitled "THE COMPUTER AIDED BUSINESS: How to Beat The Competition and Win New Customers".

Chaired by the Rt. Hon. Lord Chalfont OBE, MC, the conference session starts on the premise that today's computer based technology has advanced well beyond the vital function of speeding up paperwork.

The speakers at the conference session will address themselves to the difficulties that many directors face in recognising how such theory applies, in practice, to their own businesses.

Understanding computer based technology, applying it to business, using it to win customers through improved performance, and securing commitment from the staff that will either operate or benefit from it, will form the basis of the day-long session, which includes lunch, a computer guided visit to the exhibition, and the opportunity for an extensive question and answer session.

The conference will take place at the Metropole Hotel on Thursday, October 20, and tickets, which include documentation, lunch, drinks and entry into IBS are available at £85 each (including VAT), from The Institute of Directors, 116 Pall Mall, London SW1 5ED. Tel: 01-839 1233.

## THE FIFTH OF FORTH

The FORTH Interest Group (FIG) invites you to join them at the 5th Annual FORTH Convention on October 14-15, 1983 at the Hyatt Palo Alto in Palo Alto, California, USA. The FORTH Interest Group is a worldwide non-profit organisation of over 3500 members devoted to the dissemination of information about the FORTH computer language. The FORTH Annual Convention will focus on FORTH-based Systems and is prepared to meet the needs of every FORTH enthusiast — beginner to professional — with two days of hands-on tutorials, exhibits/vendor booths, lectures and discussions.

For further information including special convention room rates at the Hyatt Palo Alto and reservation of exhibitors space please call the FIG HOT LINE (415) 962-8653 or write to the FORTH Interest Group, P.O. Box 1105, San Carlos, CA94070. Convention Registration $5.00.

## THE PRUDENT BUSINESSMAN'S GUIDE TO BUYING A MICRO COMPUTER

This is a one day course for local businessmen and administrators in the "Putting the Micro to Work" series. It is being run jointly by Cambridgeshire College of Arts and Technology and Circuit UK, a Cambridgeshire based microcomputer training firm.

This course guarantees to provide an unbiased view of the

benefits and pitfalls of computerisation for the small business, as neither organisation is involved in selling computer equipment.

The course aims to help businessmen evaluate which situations could be helped by computerisation, choose the right system and find out what questions they should be putting to dealers to get the information they need.

The course is being held on 27th October 1983 at Cambridgeshire College of Arts and Technology, cost £65 which includes lunch and printed handouts. For further details contact David Bainbridge at CCAT, Cambridge CB1 2AJ, or telephone Katherine Bull on (0223) 63271.

## BBC MICROCOMPUTER COURSES

A continuation and expansion of the range of BBC microcomputing courses is planned for the Autumn and Winter of 1983/84.

The new programme will feature a wide range of courses on offer with day courses, evening courses, weekend courses and both residential and non-residential options for courses held in hotels on Saturdays or at weekends.

Emphasis is on catering for newcomers of all ages to computing, with the demand from people continuing the specially-developed BBC BASIC programming course being satisfied.

Courses aimed specifically at beginners have been incredibly successful and will cover topics such as computer graphics, how computers work, wordprocessing, advice on buying a home computer, an extensive range of demonstrations, and an introduction to programming.

The weekend residential courses are designed to attract participants from a large geographic area who want to meet with others and learn about this 'thing called computing' in a comfortable environment. They also appeal to computer-keen members of a family who may be hoping to buy a computer in the near future and where there will be no generation gap!

There are different locations and times:

Weekend (residential) hotel courses.... North Berwick.

One-day (including Saturdays) hotel courses....Edinburgh.

Short-session Day/Evening courses....East Lothian (North Berwick, Longniddry, Musselburgh, Dunbar and Haddington).

Demonstrations/Courses/Exhibitions for groups etc, by special arrangement....Glasgow, Edinburgh, Dundee and Newcastle.

There is a range of subjects:

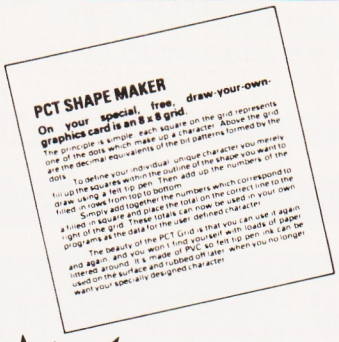
* Introducing the microcomputer (including wordprocessing)
*Beginner's BASIC programming
*Intermediate BASIC programming
*Advanced BASIC programming
*BBC Assembly Language programming (early 1984)

For further information please contact:

MICE, 14 Ware Road, North Berwick, East Lothian, EH39 4BN.

*Details of events for inclusion in this page must reach us at least six weeks prior to the starting date.*

**Computing Today, 145 Charing Cross Road, London WC2H 0EE**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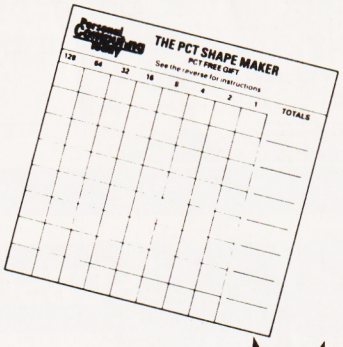


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*CT Oct '83*

# Personal SOFTWARE

The Autumn issue of our quarterly publication, Personal Software, is dedicated to the games player.

Containing over 200 reviews of commercial games software, this magazine gives a personal view of the quality, merits and downfalls of games varying in type from the home computer versions of arcade games through educational games for the younger player to the more sophisticated adventure games. Opinions are given on the addictive (or not) nature of the games, some hints on how to play them and whether they are really worth the money that you pay for them. Each game is given an overall star rating too.

If you have just bought a micro and want to peruse some of the games available for it, you can refer to the index at the back of the magazine and locate machine specific games. The more common home computers are covered including ZX81, ZX Spectrum, Dragon 32, BBC Micro, TRS-80, Apple, VIC-20 and others. Details of supplier and price are given for each game.

Personal Software will be on sale at your local newsagent from Friday 19th August, at £1.95 or you can order directly from us at £7.80 per annum or £1.95 per copy. To ensure a single copy or a complete year's supply, fill in the form below — you can even spread the load with your credit card.

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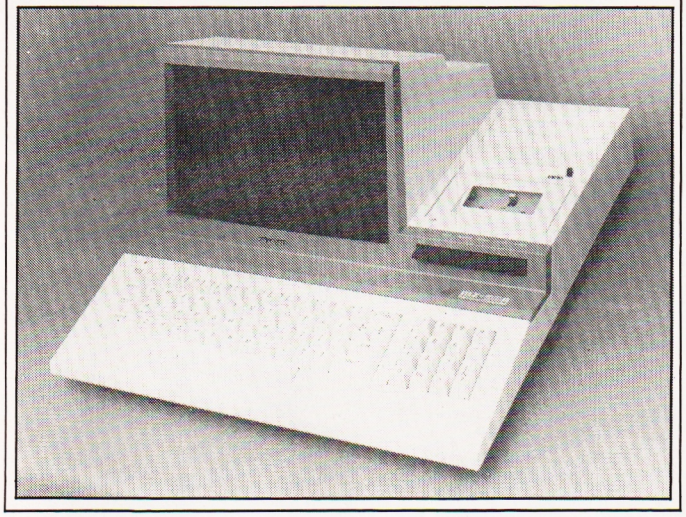
|---|---|---|---|---|
| **MEMORY** | 48K RAM | 4K ROM | | |
| **LANGUAGE** | Microsoft BASIC | | | |
| **CASSETTE** | 1200 baud (built-in) | | | |
| **DISC** | extra | DOS | | |
| **KEYBOARD** | QWERTY☑ | CURSOR☑ | NUMERIC☑ | FUNCT☐ |
| **DISPLAY** | TV☐ | MONITOR☑ | SUPPLIED☑ | |
| **INTERFACE** | PARA☑ | SERIAL☐ | BUS☑ | |
| **GRAPHICS** | BLOCK☑ | USER☐ | | |
| | LINE☐ | RES 80 by 50 | | |
| | COLOUR | TEXT 25 by 40 | | |
| **SOUND** | Single channel | | | |

**Notes:** The Sharp MZ-80A is a Z80 based micro. An expansion unit, printer, floppy disc unit and other peripherals are available. Other languages can also be used such as Pascal merely by replacing the tape. With the floppy disc option the machine can respond to higher level software such as Disc BASIC and FDOS (including BASIC compiler). A small range of business and educational software is available. The supplier is **Sharp Electronics (UK) Ltd,** Thorp Road, Newton Heath, Manchester M10 9BE.



## SHARP MZ-80B £899

| | | | | |
|---|---|---|---|---|
| **MEMORY** | 64K RAM | 2K ROM | | |
| **LANGUAGE** | BASIC (on tape) | | | |
| **CASSETTE** | 1800 baud built-in | | | |
| **DISC** | extra | DOS | | |
| **KEYBOARD** | QWERTY☑ | CURSOR☑ | NUMERIC☑ | FUNCT☐ |
| **DISPLAY** | TV☐ | MONITOR☑ | SUPPLIED☑ | |
| **INTERFACE** | PARA☐ | SERIAL☐ | BUS☑ | |
| **GRAPHICS** | BLOCK☑ | USER☐ | | |
| | LINE☑ | RES 320 by 200 | | |
| | COLOUR | TEXT 25 by 80 | | |
| **SOUND** | 3 channels | | | |

**Notes:** The Sharp MZ-80B is a Z80A based micro. Various other languages can be loaded as the machine is "soft", no language being fitted in ROM. Expansion unit, the MZ-80P5 printer and the MZ-80FB floppy disc drive are also available. The supplier is **Sharp Electronics (UK) Ltd,** Thorp Road, Newton Heath, Manchester.

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CT10

**Stephen Clarke**

# IMPROVED VIC EDITOR

**Back in November 1982 we showed how to get a bigger screen on your VIC-20. The alteration given here will make it even better!**

Being a recent VIC-20 owner, I found the VIC EDITOR article (*Computing Today* November 1982) of interest, as it showed how to improve the screen display area. However, analysis of the program shows that the 'clear screen' routine and the overall memory usage could both be improved.

## CLEARING THE SCREEN

With the larger sized screen, clearing the screen becomes a problem as the inbuilt routine will only clear the first 506 bytes of the display area. In the original article, a machine code routine was used to clear the screen. This routine worked by printing a 'space' in the 1024 bytes above the screen start location of 7168, and then colouring the 'space' black. This is inefficient as it overwrites a useful area of RAM. Since the computer has its own clear screen routine, it would be more efficient to use it, and just use the machine code routine to clear what is left.

With the values given in the original article, using the inbuilt routine leaves 326 bytes to be cleared, and this is done by Listing 1.

## STORING THE CODE

In the original article, the three machine code routines for clearing the screen, saving the screen to tape and loading the screen from tape were stored in the 256 byte block immediately below the screen. This is sheer waste, as there is more than enough space for these routines *above* the screen. This is because the screen memory was increased from 512 bytes to accommodate the larger screen area, making a possible 1024 bytes available for the screen. But, because the largest available screen size is only 27 × 33, this leaves 133 bytes free at the top of memory. This area is more than sufficient to store the three machine code routines, and, because the top of memory pointers have to be adjusted to prevent BASIC from overwriting the screen, needs no further protection. Listing 2 shows the amendments that have to be made to the original program; the lines are direct replacements. Note that function key F7 is now used to clear the screen: I find it easier to use!

```
        MNEMONIC        COMMENT
        LDY  $0286      Load colour code into Y register
        LDX  #A3        Initialise counter
RPT     LDA  #20        Load 'space' code into accumulator
        STAX $1DF9      Store 'space' in uncleared screen
        STAX $1E9C      Ditto
        TYA             Transfer colour code to accumulator
        STAX $95F9      Store in colour memory
        STAX $969C      Ditto
        DEX             Reduce counter value by one
        BNE RPT         Repeat from 'RPT' if counter not zero
        RTS             Return to BASIC
```

**Listing 1. New machine code 'clear screen' routine.**

```
240 MC=SC+833
260 SV=MC+25
270 LD=MC+56
280 POKE 56,28: POKE 52,28
300 FOR I=1 TO 78: READ A: POKE MC+I,A: NEXT
310 PRINT "[CLS]": SYS CL
410 IF A$="[F7]" THEN PRINT "[CLS]": SYS CL: P=SC: GOTO 350
880 DATA 172,134,2,162,163,169,32
890 DATA 157,249,29,157,156,30,152
900 DATA 157,249,149,157,156,150,202
910 DATA 16,238,96,234,162,1
```

**Listing 2. Replacement lines for the VIC EDITOR program.**

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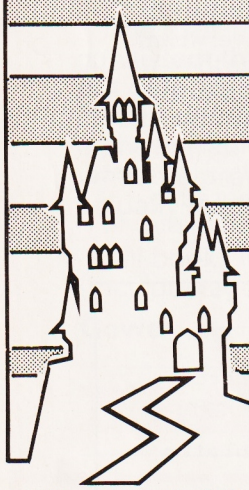

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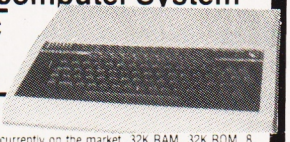

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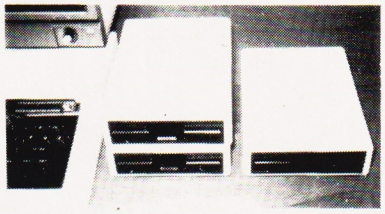

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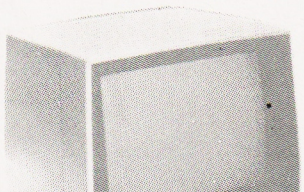

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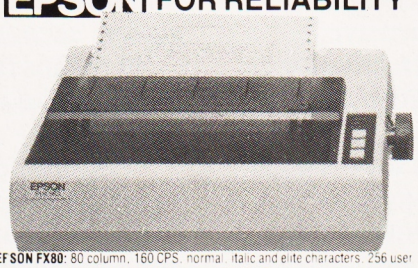

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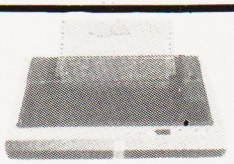

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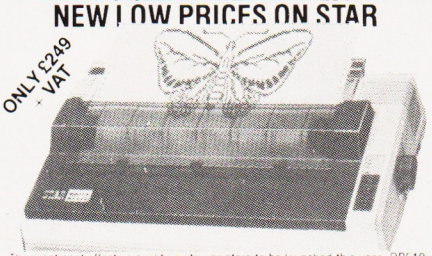


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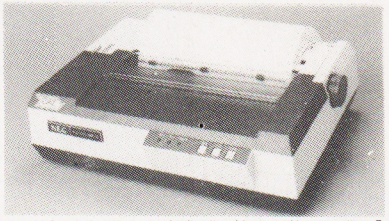

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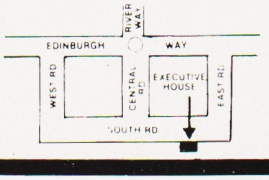

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# ADVENTUROUS SOFTWARE

**Our intrepid reviewer has ventured into the deepest memory locations of the BBC Micro and ZX Spectrum to bring back this report.**

My psychiatrist, if I had one, would doubtless be able to make much of my love of Adventure games. Obviously it's a displacement activity to compensate for the dull tedium of modern life, and I'm just aching to swap my typewriter for a broadsword and stride away, hewing limbs from multi-headed monsters, or step from a spaceship into the jungle wastes of an alien world while roasting a plant-thing with a pulse from my laser cannon.

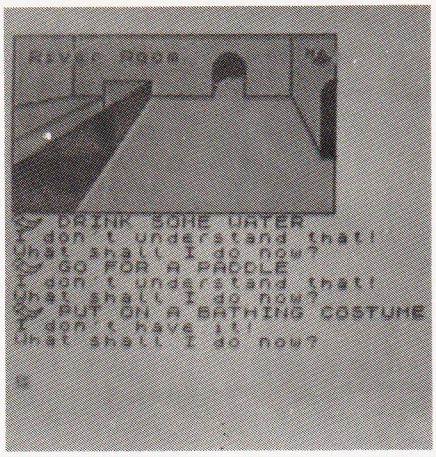
Fair enough, I suppose, a well-written adventure is an exciting bit of escapism — but the main point of them is that they provide a new type of intellectual challenge. Once upon a time acrostics were all the rage, then crosswords took over. Now anyone with a computer can pit his wits against this latest type of puzzle.

For this article I tried to crack four of the offerings in this field. The first two games are for the ZX Spectrum, while the remaining two are for the BBC Model B.

## PHARAOH'S TOMB

The Hobbit started a new trend when it appeared, and several adventures since then have featured a graphical representation in a screen window to augment or replace the text description of your location. Pharaoh's Tomb begins with a scene at a desert oasis, with a sand dune to the east and a path winding away to the north. There are several such scenes throughout the game, while other locations rely purely on a textual display. Locations with a picture sometimes have additional information about the nature of the location printed to the right, and in all cases a horizontal rule divides the screen into two halves. Any objects of interest are described below this rule, and the player's responses are also transferred here from the input line at the bottom of the screen. The area below the rule scrolls if necessary, leaving the upper half of the screen intact.

The authors state that machine code is used for all the vocabulary scanning, screen control and picture painting, so as to provide fast responses for the common activities. If this is fast, I'm glad the program wasn't written in BASIC! Sometimes it can get very tedious waiting for things to happen, especially in a place like the maze, where the screen picture is drawn every time you take a step, and every time you perform some other action (you'll have to find out what for yourself!) that is required to map the maze properly. A better system may have been to display the full graphical scene when you first enter a location, then use a single abbreviated text line on further visits unless the player requests a LOOK.




An odd thing about the text recognition is that the north, south, east and west requests are dealt with much faster than up or down.

The game itself is reasonable, if a trifle illogical in places (a block of ice that doesn't melt when you carry it around?). The object is to plunder the ancient tomb of its golden treasures and take them back to the oasis. I managed to waste a great deal of time during play before I realised that not every graphical location has a function, while some of the text-only rooms are among the most important. I suppose it adds to the difficulty of the game if you're not certain whether an instruction has failed because you haven't been devious enough in your logic, or because you're in a useless, 'dummy' location, but it's very frustrating waiting for a dummy room to be drawn every time you have to pass through it.

For the price, though, this is a fair adventure which will keep a novice adventure busy for some time, though I doubt whether old hands will have much difficulty cracking it.

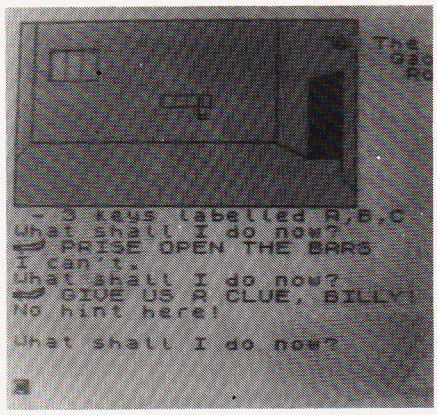
*PHARAOH'S TOMB*
*Phipps Associates,*
*99 East Street,*
*Epsom,*
*Surrey KT17 1EA*
*Price: £4.95 (cassette)*
*Machine: 48K ZX Spectrum*

## MAGIC MOUNTAIN

Another adventure from Phipps Associates, this game uses the same format as Pharaoh's Tomb. There's a split screen with either a pictorial or textual description of the current location above, and the scrolling command area below. In some ways I feel it would be an even better for a beginner than the previous game as there are fewer locations, but equally there are fairly obscure actions that have to be performed to complete the quest. The object you seek is the Scroll of Wisdom.

I did get rather annoyed about some of the arbitrary ways that user input was treated. In Magic Mountain there are several items which must be purchased, and for the first ones the request to USE COIN gets the required response. Then for some reason, when you try to USE COIN for the final time the computer replies "You can't do that". Instead you have to say BUY XXXX (you'll have to find which item yourself, I'm afraid!).

Further confusion arises, in both games, because in most places a two-word instruction is sufficient — but not all. This leaves you guessing whether you've got the right idea but the wrong way of asking for what you want. At one point in Magic Mountain I finally realised that a six-



word request was necessary to get the required action. Again, in Pharaoh's Tomb I had opened a locked door to the east, but was told I could neither GO EAST nor ENTER DOOR. Eventually I hit on GO THROUGH DOOR, but this sort of complication detracts from rather than improves the quality of an Adventure, in my opinion. I buy Adventures to pit my wits against the programmer by solving the riddles he poses — if I wanted to play word games, it would be cheaper to buy a copy of the Times and do the crossword. I think there's a good case for allowing the player to see a vocabulary of all the words (or at least all the verbs) that the computer will recognise, and writing the game so that the player's general intention is recognised and carried out, rather than insisting on exactly the right syntax. That would let you get on with cracking the problems.

Apart from this 'language barrier' the game wasn't too bad, but it seemed a curious mix of situations, with some fairly obvious solutions and others which might cause great difficulty (sometimes because of rather misleading place descriptions). On the whole, though, this tape isn't bad value for money.

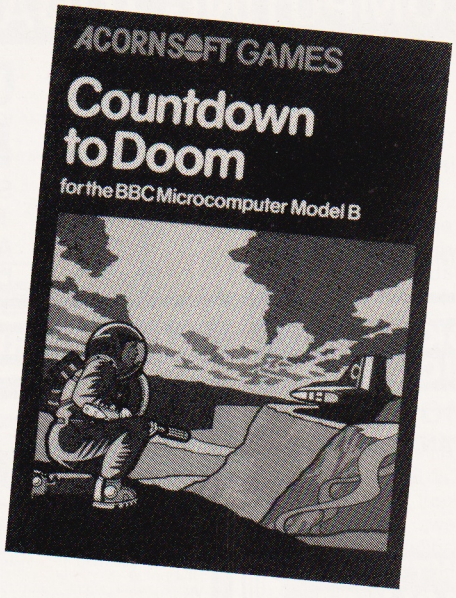
*MAGIC MOUNTAIN*
*Phipps Associates,*
*(address as above),*
*Price: £4.95*
*Machine: 48K ZX Spectrum*

## COUNTDOWN TO DOOM

This adventure (and the following one) are written by Peter Killworth for Acornsoft. I should like to meet Mr Killworth sometime, partly to see just how warped he is and partly to physically assault him! These Adventures are very tricky indeed, and resulted in much tearing of hair as I stumbled from one nasty death to another. Both Adventures are text only, with a continuously scrolling screen.

The scenario in Countdown To Doom is that your spaceship has crashed on a deserted planet and requires extensive repairs before you can take off. While looking for the components required, you may also come across some treasures, which you must take back to the ship's hold before take-off to score maximum points. The inventiveness of the obstacles you have to overcome and the excellent descriptions of the locations make this a very satisfying game to play.

All commands are of the one or two word variety, but surprisingly the response time, and in particular the time taken to print out the text,




are quite slow. Since BBC BASIC is just about the fastest on the micro scene, this can only be due to bad programming techniques, an opinion which was confirmed by examining a listing of the program. (*Solving* the game by listing it is frowned upon in adventuring circles, by the way!). Nevertheless the game is faster than many others on the market.

A warning for people as impatient as me — the BBC Micro allows you to 'type ahead' because keyboard entry is stored in a buffer. Several times I used this facility on a section of the game I had already worked out, but inadvertently made a typing error. If this should lead to accidental death, then the "Do want to play again?" message comes up, but this has been (badly) programmed so that any key other than Y wipes the program, necessitating a lengthy reload when the next character leaves the buffer. Please, Mr Killworth, write any future programs so that pressing any key other than N causes a restart: it's much kinder when programs are failsafe.

I enjoyed this Adventure very much indeed, although I failed to score maximum points (apparently I missed a piece of treasure, although I'm certain I went everywhere). At £9.95 it represents good value for money — I certainly got many hours of enjoyment out of it.

*COUNTDOWN TO DOOM*
*Acornsoft,*
*4a Market Hill,*
*Cambridge CB2 3NJ*
*Price: £9.95*
*Machine: BBC Model B*

## PHILOSOPHER'S QUEST

Especially recommended for masochists, this game is quite simply perverse. After playing it for several days I still only scored 134 out of a possible 250 and am somewhat at a loss for what to try next. The author has obviously had a great deal of fun dreaming up the plot, and has taken a particular delight in arranging things so that, having solved a major problem, you take one step and promptly die in yet another evil trap.

The plot is almost impossible to describe, although eventually it becomes apparent that there's a shaggy dog story! Along the way you meet an ancient mariner, a sad octopus, a thirsty old lady and, if you're unlucky, a god-like voice which turns you into a lettuce leaf for some indiscretion. Humour abounds both in the nature of the objects you find (a jewelled platypus?) and in the descriptions of the various locations and things that happen to you.

Like the previous Adventure, Philosopher's Quest uses scrolling text and responds at about the same speed. Fortunately both games give abbreviated descriptions of places after you've visited them for the first time.

This tape has given me a great deal of pleasure and I hope to get a great deal more out of it. Only people with really devious minds can hope to solve it without help, though. Highly recommended.

*PHILOSOPHER'S QUEST*
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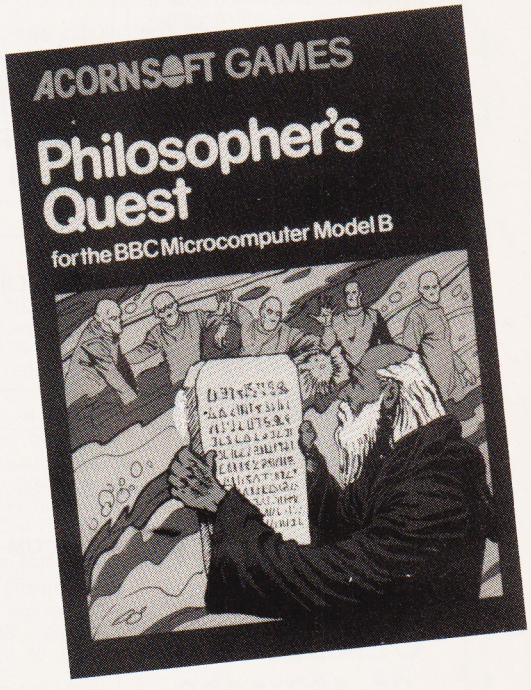

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Write to us on your letter headed paper, and ask for our special TRADE PACK. You will receive an SDL Gift Voucher and details of our special prices and offers. Our diskette prices allow you good margins AND their very high quality ensures that you can sell 'em and forget 'em! Furthermore we enclose a FREE CREDIT CARD CALCULATOR and SDL voucher with every 100 disks shipped. Those of you selling Software or Hardware will be interested in our vendor branding brochure, which will also be enclosed.

5¼ inch and 8 inch diskettes 98p each

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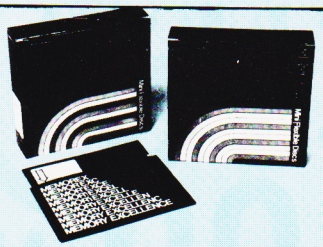
With Every TWO Ten-Packs of ANY 5.25" or 8" disks by Maxell, Datalife or Memorex, purchased at these prices, we will pack a FREE Super Slim Credit Card Memory calculator, complete with credit card wallet. Order four Ten-Packs, and you will receive two calculators and so on.

1 - DISK DIRECTORY
2 - DISKWRITER
3 - SDL GIFT VOUCHER
4 - SEE 10 LIBRARY BOX

**FREE** with EVERY TEN-PACK of diskettes from DISKING at these prices.

The complete DISKING DATA PROCESSING package

● Circle No. 193



### MEMOREX - Memory Excellence

When it comes to PRICE/PERFORMANCE, MEMOREX wrote the book. Their new Japanese media is very conservatively rated, and certification levels are easily surpassed in actual performance. Protected by a special anti-static lubricant, head performance and media life is also extended.

#### 5¼" DISKETTES

Certified for Single OR Double Density and all with hub ring reinforcement.

| PRICES EXC VAT | | 10-40 | 50-90 | 100+ |
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| 3504 | S/Sided 96 tpi Soft Sect | 27.90 | 26.90 | 25.90 |
| 3505 | S/Sided 96 tpi 10 Hard Sect | 27.90 | 26.90 | 25.90 |
| 3506 | S/Sided 96 tpi 16 Hard Sect | 27.90 | 26.90 | 25.90 |
| 3501 | D/Sided 96 tpi Soft Sect | 34.90 | 33.90 | 32.90 |
| 3502 | D/Sided 96 tpi 10 Hard Sect | 34.90 | 33.90 | 32.90 |
| 3503 | D/Sided 96 tpi 16 Hard Sect | 34.90 | 33.90 | 32.90 |

48 tpi suitable for 35 and 40 track operation
96 tpi suitable for 77 or 80 track operation

#### 8"DISKETTES

| PRICES EXC VAT | | 10-40 | 50-90 | 100+ |
|---|---|---|---|---|
| 3064 | S/Sided S/Dens. Soft Sect | 23.90 | 22.90 | 21.90 |
| 3015 | S/Sided S/Dens. 32 Hard Sect | 23.90 | 22.90 | 21.90 |
| 3090 | S/Sided D/Dens. Soft Sect | 26.90 | 25.90 | 24.90 |
| 3091 | S/Sided D/Dens. 32 Hard Sect | 26.90 | 25.90 | 24.90 |
| 3102 | D/Sided D/Dens. Soft Sect | 32.90 | 31.90 | 30.90 |
| 3181 | D/Sided D/Dens. 32 Hard Sect | 32.90 | 31.90 | 30.90 |

### DATALIFE by Verbatim - With Five Year Warranty

VERBATIM have not become the World's favourite floppy disks by accident. Perfect magnetic media is their stock in trade, and to prove it they now offer an unconditional FIVE YEAR warranty on all DATALIFE products.

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Certified for Single OR Double Density, and all with hub ring reinforcement.

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|---|---|---|---|---|
| MD525-01 | S/S 48 tpi Soft Sect | 22.90 | 21.90 | 20.90 |
| MD525-10 | S/S 48 tpi 10 Hard Sect | 22.90 | 21.90 | 20.90 |
| MD525-16 | S/S 48 tpi 16 Hard Sect | 22.90 | 21.90 | 20.90 |
| MD550-01 | D/S 48 tpi Soft Sect | 29.90 | 28.90 | 27.90 |
| MD550-10 | D/S 48 tpi 10 Hard Sect | 29.90 | 28.90 | 27.90 |
| MD550-16 | D/S 48 tpi 16 Hard Sect | 29.90 | 28.90 | 27.90 |
| MD577-01 | S/S 96 tpi Soft Sect | 28.90 | 27.90 | 26.90 |
| MD577-10 | S/S 96 tpi 10 Hard Sect | 28.90 | 27.90 | 26.90 |
| MD577-16 | S/S 96 tpi 16 Hard Sect | 28.90 | 27.90 | 26.90 |
| MD557-01 | D/S 96 tpi Soft Sect | 36.90 | 35.90 | 34.90 |
| MD557-10 | D/S 96 tpi 10 Hard Sect | 36.90 | 35.90 | 34.90 |
| MD557-16 | D/S 96 tpi 16 Hard Sect | 36.90 | 35.90 | 34.90 |

48 tpi suitable for 35 or 40 track operation
96 tpi suitable for 77 or 80 track operation

#### 8" DISKETTES

| PRICES EXC VAT | | 10-40 | 50-90 | 100+ |
|---|---|---|---|---|
| FD34-9000* | S/S S/Dens. Soft Sect | 31.90 | 30.90 | 29.90 |
| FD32-9000* | S/S S/Dens. 32 Hard Sect | 31.90 | 30.90 | 29.90 |
| FD34-8000 | S/S D/Dens. Soft Sect | 31.90 | 30.90 | 29.90 |
| FD32-8000 | S/S D/Dens. 32 Hard Sect | 31.90 | 30.90 | 29.90 |
| DD34-4001 | D/S D/Dens. Soft Sect | 36.90 | 35.90 | 34.90 |
| DD32-4000 | D/S D/Dens. 32 Hard Sect | 36.90 | 35.90 | 34.90 |

*For critical applications

### MAXELL - The Gold Standard

Maxell consistently meet or exceed all standards, and have run disks under conditions designed to find weak points and wear. They couldn't and you won't. These diskettes are the quietest in operation we know.

#### 5¼" DISKETTES

Certified for Single OR Double Density
48 tpi media with hub ring

| PRICES EXC VAT | | 10-40 | 50-90 | 100+ |
|---|---|---|---|---|
| MD1-D | S/Sided 48 tpi Soft Sect | 24.90 | 23.90 | 22.90 |
| MH1-10 | S/Sided 48 tpi 10 Hard Sect | 24.90 | 23.90 | 22.90 |
| MH1-16 | S/Sided 48 tpi 16 Hard Sect | 24.90 | 23.90 | 22.90 |
| MD2-D | D/Sided 48 tpi Soft Sect | 32.90 | 31.90 | 30.90 |
| MH2-10D | D/Sided 48 tpi 10 Hard Sect | 32.90 | 31.90 | 30.90 |
| MH2-16D | D/Sided 48 tpi 16 Hard Sect | 32.90 | 31.90 | 30.90 |
| MD1-DD | S/Sided 96 tpi Soft Sect | 32.90 | 31.90 | 30.90 |
| MD2-DD | D/Sided 96 tpi Soft Sect | 42.90 | 41.90 | 40.90 |

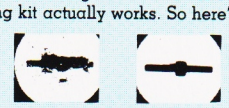
#### 8" DISKETTES

| PRICES EXC VAT | | 10-40 | 50-90 | 100+ |
|---|---|---|---|---|
| FD1-128 | S/S S/Dens. Soft Sect | 29.90 | 28.90 | 27.90 |
| FH1-32 | S/S S/Dens. 32 Hard Sect | 29.90 | 28.90 | 27.90 |
| FD1-XD | S/S D/Dens. Soft Sect | 34.90 | 33.90 | 32.90 |
| FH1-32D | S/S D/Dens. 32 Hard Sect | 34.90 | 33.90 | 32.90 |
| FD2-XD | D/S D/Dens. Soft Sect | 39.90 | 38.90 | 37.90 |
| FH2-32D | D/S D/Dens. 32 Hard Sect | 39.90 | 38.90 | 37.90 |

### DISKETTE CARE AND MAILING

DISK DRIVE HEAD CLEANING KITS

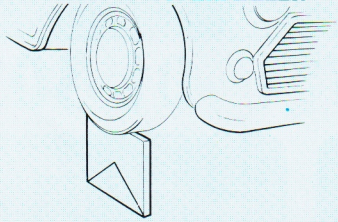
We're fed up with being asked whether our disk drive head cleaning kit actually works. So here's the proof:-

BEFORE.  AFTER

Can you really risk that breakdown?

CK5 for 5¼" disk drives ..... **14.90**
CK8 for 8" disk drives ..... **14.90**

#### 5¼" DISKETTE MAILERS
#### The NEW DISKING 'SUPERMAILER'



* COPYRIGHT DESIGN - Unlike the rest, this ingenious mailer has a flute crossing action when folded, resulting in a virtually unbendable mailer.

* CAVERNOUS CAPACITY - will take, one, two, three or even four diskettes WITH envelopes.

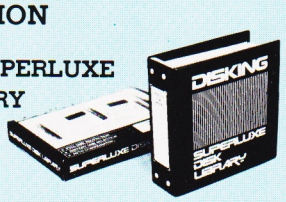
* FULL INSTRUCTIONS - Each DISKING 'SUPERMAILER' is printed with full instructions and comes complete with addressing/sealing label.

*PACKED IN 100'S - For convenience

| 1 PACK | 2 PACKS | 3+ PACKS |
|---|---|---|
| 24.90 | 22.90 | 19.90 |

### DISKETTE STORAGE AND PROTECTION

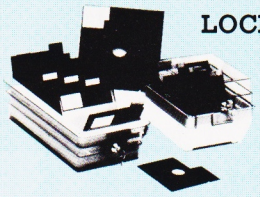
#### DISKING SUPERLUXE DISK LIBRARY (5¼" only)




The whole area of your disk, its labelling and its envelope are fully visible for INSTANT selection ANYTIME.

#### AVAILABLE IN TWO VERSIONS

| PRICES EXC VAT | 1-2 | 3-4 | 5-9 | 10+ |
|---|---|---|---|---|
| SDL (For 20 minidisks) | 9.95 | 8.95 | 7.95 | 6.95 |
| SDLX (For 28 minidisks) | 11.95 | 10.95 | 9.95 | 8.95 |
| Uprating Conversion Kit | 2.00 | | | |



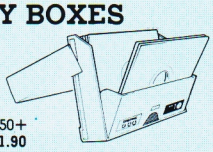
#### LOCKABLE DISKETTE STORAGE

These anti-static, ABS plastic diskette storage boxes come in four sizes, two for mini disks and two for 8" disks.
They have a white base with a transparent smoked lockable lid, and hold 40 or 80 diskettes.
They come complete with keys and dividers.

PRICES EXC VAT
M35 40 minidisk capacity ..... **14.90**
M85 80 minidisk capacity ..... **18.90**

F40 40 8" diskette capacity ..... **18.90**
F80 80 8" diskette capacity ..... **27.90**

#### SEE 10 LIBRARY BOXES



| PRICES EXC VAT | 1-49 | 50+ |
|---|---|---|
| SEE 10 for minidisks only | 2.50 | 1.90 |

The new SEE 10 is probably the best 5¼" library box around.
(FREE with every ten disks ordered)

**U.K. TERMS, CONDITIONS & SHIPPING RATES INC. INS. EXC. VAT**

**5¼" DISKETTES**
1-2 Packs each pack @ 95p
3-5 Packs each pack @ 75p
6-9 Packs each pack @ 60p
10+ Packs ★POST FREE★

**8" DISKETTES**
1-2 Packs each pack @ £1.60
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SEE 10 5-9 off @ 30p
SEE 10 10+ @ 20p

**8" LIBRARY BOXES**
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**DISKING SUPERLUXE DISK LIBRARY (5¼" ONLY)**
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**NORMAL ORDERS - We now welcome any official Government orders.**
We are now happy to accept any official orders with a minimum value of £30.00 from Government Departments, Ministries and Local Authorities. We do this on the understanding that invoices will be settled within thirty days or preferably less please.
Alternately, you may send your remittance with your order if you so wish.
All other non Government bodies, cheques with order please payable to DISKING. If you are a large establishment, and cannot raise cheques without an invoice please post or telephone us your order, and we will send a pro-forma invoice by return, for your accounts department to pay against.
Also bear in mind, that you do have to pay VAT, which will be added to these prices.
If you are in any doubt, please see the order form on this brochure to help you with your calculations, or telephone us for assistance.

**CREDIT CARD ORDERS**
We welcome Access (Mastercharge), Barclaycard (VISA) & Diners Club International, & there is NO credit card surcharge. You may write your c/card No. on your order or telephone the order day or night, 365 days a year. You may speak for as long as you like, (but don't leave long gaps otherwise our machine thinks you've gone home) and don't forget to give the following details:-
1. The Cardholder Name, Address and day time telephone number.
2. Delivery Address if different.
3. First Class, ordinary or special post.
4. Your Credit Card Number.
5. What you wish to Order.
6. State whether purchasing from our General price list or Budget price list.
**You may leave the rest to US!!**

**URGENT ORDERS**
If you're posting your order, omit the word FREEPOST from our address, and use our normal postcode GU30 7EJ and do not forget to stamp it FIRST CLASS. If you are a Government body as defined under 'NORMAL ORDERS' and are telephoning your official order OR are an individual or company using your credit card No., please make it clear that you wish to pay for your goods to be sent to you by FIRST CLASS POST.

| FIRST CLASS RATES EXC VAT | MINIDISKS | 8" DISKETTES |
|---|---|---|
| First TEN-PACK | 2.00 | 2.50 |
| Second and subsequent TEN-PACK | 1.50 | 2.00 |

**DESPERATE ORDERS U.K.**
Your options are:- DATAPOST Which will deliver the goods within the United Kingdom over night (usually before 10 am the next day) provided they are ordered and paid for from DISKING by 3.00 pm or EXPRESSPOST Which will deliver the goods the SAME DAY provided they are ordered and paid for from DISKING by 10.30 am, and provided you are no further north than Manchester.
These services put great stress on our sales order processing and packaging departments. Please therefore, spare a thought for our girls, and make sure that:-
a) The required goods are in stock and
b) A full complement of manpower and vehicles are available at DISKING

| PRICES | EXC VAT |
|---|---|
| DISKING DATAPOST (Up to 5Kg) | 10.90 |
| Per additional 1Kg to 10Kg add | 1.00 |
| Over 10 Kg up to 27.5Kg | 20.00 |
| Approximate Weights for guidance only:- | |
| 100 Minidisks without LB's | 3Kg |
| 100 Minidisks with LB's | 6Kg |
| 100 x 8" disks without LB's | 5Kg |
| 100 x 8" disks with LB's | 10Kg |
| DISKING EXPRESSPOST | |
| Distances are from Liphook Hampshire | |
| Under 20 miles | 15.00 |
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Don't buy a T.V. game! Buy an Atari 400 personal computer and a game cartridge and that's all you'll need. Later on you can buy the Basic Programming cartridge (£35) and try your hand at programming using the easy to learn BASIC language. Or if you are interested in business applications, you can buy the Atari 800 + Disk Drive + Printer together with a selection of business packages.

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- PART EXCHANGE SECOND HAND MACHINES - we offer a part exchange scheme to trade in many makes of T.V. games for personal computers.
- COMPETITIVE PRICES - our prices, offers and service are very competitive. We are never knowingly undersold and will normally match any lower price quoted by our competitors.
- HELPFUL ADVICE - available on the suitability of various computers.
- AFTER SALES SERVICE - available on all computers out of guarantee.
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